Re: Pest Management Research Report - 1995

The Official Title of the Report

1996. Pest Management Research Report - 1995: Compiled for the Expert Committee on Integrated Pest Management, by Agriculture and Agri-Food Canada, Information and Planning Services, Ottawa, Ontario, Canada K1A 0C6. February, 1996. (Published on diskette only).

What is on the diskette

There are five WordPerfect 5.1 text files on this diskette.
README.DOC (1) contains the title page and table of contents.
95INSECT.REP (2) contains the biological practices and entomology sections.
95DISEAS.REP (3) contains the diseases, nematode and residue sections.
CHEMDEF.LIS (4) contains the pest control products and chemical definitions.
INDEX.LIS (5) contains eight indices of the 1995 report and indexes the:

- Products (chemicals)
- Hosts (crops)
- Pests (insects and diseases)
- Non-target Organisms
- Residues
- Biological Control Methods
- Authors and Establishments

Note: The numbers in the table of contents and the indices refer to individual report numbers, not printed page numbers.

To Read the Report

The files can be read by any IBM or IBM compatible PC using WordPerfect software. The files have been saved in 5.1. If you use 6.1 your PC will automatically convert the files.

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To Print the Report

To print individual research reports, or the complete version of the report, WordPerfect will automatically reformat the file for your printer. The pitch and margin settings are stored as part of the document and should not be changed.

Note: Because of variations in printers each file (2 - 5) starts with page 1. If you need a hard copy with continuous page numbers, example 1 - 419, append the files to make one large file on your hard drive. It is important that you append the files in their correct order.

This is the last year Information and Planning Services will be producing the report.

Sujet : Rapport de recherches sur la lutte dirigée - 1995

Titre officiel du document

1996. Rapport de recherches sur la lutte dirigée - 1995. Compilé par le Comité d'experts sur la lutte intégrée, par Agriculture et Agroalimentaire Canada, Services d'information et de planification, Ottawa (Ontario) Canada K1A 0C6. Février, 1996. (Publié sur disquette).

Instructions pour l'utilisation de la disquette

Cette disquette contient cinq fichiers de texte WordPerfect 5.1.
README.DOC (1) contient l'avant-propos et la table des matières.
95INSECT.REP (2) contient les pratiques biologiques et les sections d'entomologie.
95DISEAS.REP (3) contient les sections sur les maladies, les nématodes et les résidus.
CHEMDEF.LIS (4) contient les produits anti-parasitaires et les définitions chimiques.
INDEX.LIS (5) contient les huit indices pour le Rapport de recherche pour les indexes :

- Produits (chimiques)
- Hôtes (cultures)
- Ravageurs (insectes et maladies)
- Organismes visés
- Résidus
- Méthodes de lutte biologique
- Auteurs et Établissements

Veuillez noter que les numéros dans la table des matières et les indices correspondent aux numéros de rapport et non pas aux numéros de page.

Pour lire le rapport

On peut lire ces fichiers à l'aide d'un ordinateur personnel IBM ou d'un ordinateur personnel compatible IBM et d'un logiciel WordPerfect. Les fichiers sont sur WordPerfect 5.1. Si vous avez 6.1 votre ordinateur les convertira automatiquement.

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Pour imprimer le rapport

Si vous désirez imprimer des rapports de recherche partiels, ou la version complète du rapport, WordPerfect va automatiquement reformater le fichier selon les valeurs implicites de votre imprimante. Les paramètres pour l'interligne et les marges sont enregistrés comme faisant partie du document et ne devraient pas être modifiés.

Note : À cause des variations d'imprimantes, les fichiers 2 à 5 commencent avec les numéros de page 1.

101-02454/

Si vous avez besoin d'une copie finale avec les numéros de pages continuelles, exemple : 1 à 419, mettre les fichiers ensemble pour faire un document sur le disque dur en suivant l'ordre mentionné ci-haut.

C'est la dernière année que le Services d'information et de planification présente ce rapport. Pour l'information sur les procédures pour l'année 1996, s'il-vous-plaît contacter Stephanie Hilton au Centre de recherches sur la lutte antiparasitaire à London. Tél. (519) 457-1470 ou Télécopie (519) 457-3997.

Merci.

Betty Anne Morrison
Compilatrice (613) 759-1941

1995 PEST MANAGEMENT RESEARCH REPORT

Compiled for:

THE EXPERT COMMITTEE ON INTEGRATED PEST MANAGEMENT

Chairperson: Hugh G. Philip, P.Ag.

by:

Information and Planning Services
Research Branch, Agriculture and Agri-Food Canada
Ottawa, Ontario
CANADA K1A 0C6

FEBRUARY, 1996

This annual report is designed to encourage and facilitate the rapid dissemination of pest management research results amongst researchers, the pest management industry, university and government agencies, and others concerned with the development, registration and use of effective pest management strategies. The use of alternative and integrated pest management products is seen by the ECIPM as an integral part in the formulation of sound pest management strategies. If in doubt about the registration status of a particular product, consult the Plant Industry Directorate, Food Production and Inspection Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario, K1A 0C5.

This year there were 159 reports. The Expert Committe on Integrated Pest Management is indebted to the researchers from provincial and federal departments, universitites, and industry who submitted reports, for without their involvement there would be no report. Our special thanks is also extended to the section editors for reviewing the scientific content and merit of each report, and to the staff members of the Research Information Management Service for editorial and computer compilation services.

Suggestions for improving this publication are always welcome. Please send your comments by mail or FAX to the Chairperson of the ECIPM.

RAPPORT DE RECHERCHE EN LUTTE DIRIGÉE 1995

Préparé pour:

LE COMITÉ D'EXPERTS SUR LA LUTTE INTÉGRÉE

Président : Hugh G. Philip, P.Ag.

par:

Services d'information et de planification
Direction générale de la recherche, Agriculture et Agroalimentaire Canada
Ottawa (Ontario)
CANADA K1A 0C6

FÉVRIER 1996

La compilation du rapport annuel vise à faciliter la diffusion des résultats de la recherche dans le domaine de la lutte antiparasitaire parmi les chercheurs, l'industrie, les universités, les organismes gouvernementaux et tous ceux qui s'intéressent à la mise au point, à l'homologation et à l'emploi de stratégies antiparasitaires efficaces. L'utilisation de produits de lutte intégrée ou de solutions de rechange est perçue par Le Comité d'experts sur la lutte intégrée (CELI) comme faisant parti intégrante d'une stratégie judicieuse en lutte antiparasitaire. En cas de doute au sujet du statut d'enregistrement d'un produit donné, veuillez consulter la Direction de l'industrie des produits végétaux, Direction générale de la production et de l'inspection des aliments, Agriculture et Agroalimentaire Canada, Ottawa (Ontario) K1A 0C5.

Cette année, nous avons donc reçu 159 rapports. Les membres du Comité d'experts sur la lutte intégrée tiennent à remercier chaleureusement les chercheurs des ministères provinciaux et fédéraux, des universités et du secteur privé sans oublier les rédacteurs, qui ont fait la révision scientifique de chacun des rapports et en ont assuré la qualité, et le personnel du Service à la direction de l'information sur la recherche scientifique qui ont fourni les services d'édition et de compilation sur ordinateur.

Vos suggestions en vue de l'amélioration de cette publication sont toujours très appréciées. Veuillez donc envoyer vos commentaires par la poste ou par télécopieur au président du Comité d'experts sur la lutte intégrée.

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PEST MANAGEMENT METHODS / MÉTHODES DE LUTTE DIRIGÉE

BIOLOGICAL CONTROL / LUTTE BIOLOGIQUES

Section Editors / Réviseurs de section :

Weeds / Mauvaises herbes : R. DeClerck-Floate,
Insects, Mites, Nematodes / Insectes, acariens, nématodes : D.R. Gillespie

#001 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 375-1431-4733

CROP: Alfalfa

PEST: Lygus bugs, *Lygus* spp.

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TITLE: THE USE OF LACEWINGS (NEUROPTERA: CHRYSOPIDAE) FOR THE BIOLOGICAL CONTROL OF LYGUS BUGS IN ALFALFA SEED FIELDS

MATERIALS: Lacewing *(Chrysopa) Chrysoperla rufilabris* (Burm.) (Neuroptera: Chrysopidae) gravid females

METHODS: A shipment of gravid lacewing females was received from BioFac, Inc., Mathis Texas, on 21 June, 1995. The lacewings were released at a rate of approximately 125/ha at several points in a 6 ha field of Rangelander alfalfa near Spiritwood, Saskatchewan. A second similar field of 8 ha approximately 2 km away served as a control. Both fields were in a heavily treed area of aspen parkland and were surrounded by dense poplar bush. A second shipment of gravid lacewing females was received from Bugs Away Inc., Wilder, Idaho on 29 June. This release was made near Shellbrook, Saskatchewan, in a 16 ha field of Peace alfalfa, with a 12 ha field 2 km away serving as a control. These fields were in a less heavily wooded area than those at the Spiritwood site; about half of their perimeters was enclosed by aspen shrubs. Four to eight locations were sampled in each field at each sampling date; five walking sweeps of 180° with a standard 38 cm insect net were taken at each location. Fields were swept periodically during the summer and the numbers of 1 - 3 stage, 4 - 5 stage and adult lygus bugs, the numbers of pea aphids and lacewings and in the case of the Shellbrook site, the numbers of minute pirate bugs, ladybird beetles and damsel bugs was recorded from each field.

RESULTS: The control field at Spiritwood was inadvertently sprayed with dimethoate near the time of lacewing release and numbers of insects were low for most of the summer. No lacewing adults or larvae were recovered from either of the Spiritwood fields. By August, population levels were similar in the control and release fields near Spiritwood for both lygus and pea aphids.

At Shellbrook, none of the three lygus population components measured, 1 - 3 instar nymphs, 4 - 5 instar nymphs and adults, were different between the two fields (Table 1. paired t-tests on population data transformed by square root + 0.5). Differences in pea aphid population data were not statistically different (Table 2). Lacewing numbers were very low in both fields, with no statistical differences between them (Table 3). Likewise, the number of minute pirate bugs, ladybird beetles and damsel bugs did not differ between fields.

CONCLUSIONS: Release of lacewings as gravid females in alfalfa seed fields in late June did not increase lacewing populations in release fields compared to control fields and had no measurable effect on lygus or pea aphid numbers. It is possible that lacewings did not remain in the release fields to lay their eggs.

Table 1. Number of lygus swept on five dates in alfalfa seed fields in which lacewings had (Release Field) or had not (Control Field) been released for pest control, Watson, Saskatchewan, 1995.*

	Number of Lygus/Sweep**														
	1-3	4-5	A	1-3	4-5	A	1-3	4-5	A	1-3	4-5	A	1-3	4-5	A
Field	20/06/95			6/07/95			17/07/95			01/08/95			30/08/95		
Release	9.3	1.1	1.9	11.8	3.4	1.5	8.9	16.1	3.9	3.8	9.7	4.9	0.2	0.8	9.6
Control	7.5	2.2	1.6	11.7	3.7	1.2	6.3	14.5	3.1	4.4	9.1	7.8	0.2	2.3	10.1

* Mean of four replicates. None of the differences in numbers between fields was significant (t-test, P>0.05).

** 1-3 = First to third stage, 4-5 = fourth to fifth stage, A - adult lygus.

Table 2. Number of pea aphids swept in alfalfa seed fields in which lacewings had (Release Field) or had not (Control Field) been released for pest control, Watson, Saskatchewan, 1995.*

	Number of Pea Aphids/Sweep				
Field	20/06	6/07	17/07	01/08	30/08
Release	6.5	44.8	182.1	148.1	1.3
Control	6.6	37.0	104.7	162.2	2.8

* Mean of four replicates. None of the differences in numbers between fields was significant (t-test, P>0.05).

Table 3. Number of lacewing larvae and adults swept in alfalfa seed fields in which lacewings had (Release Field) or had not (Control Field) been released for pest control, Watson, Saskatchewan, 1995.*

	Number of Lacewings/Sweep				
Field	20/06	6/07	17/07	01/08	30/08
Release	0	0	0	0.6	0
Control	0	0	0	0.3	0

* Mean of four replicates. None of the differences in numbers between fields was significant (t-test, P>0.05).

#002

CROP: Barley, cv. various

PEST: Canada thistle, Quackgrass

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TITLE: RELATIVE COMPETITIVENESS OF THIRTY-EIGHT BARLEY CULTIVARS WITH ESTABLISHED QUACKGRASS AND CANADA THISTLE INFESTATIONS

MATERIALS AND METHODS: There is little information on the relative competitiveness of cereal cultivars with major weeds on the Canadian prairies. Generally, broadleaf annuals can be controlled effectively in cereals with herbicides. However, perennial weeds are difficult to control in cereals. With an increasing emphasis on zero and conservation tillage, perennial weeds, in particular, are becoming problematic. A preliminary experiment was conducted to determine if there was some useful level of competitiveness in barley to two of the most common and difficult perennial weed problems in reduced tillage, quackgrass and Canada thistle. If weed-competitive barley cultivars could be found, they potentially could be developed to help reduce the costs of weed control. Established patches of quackgrass and Canada thistle were identified in the summer of 1994 and spring of 1995 at the Zero-Tillage Experimental Farm, Rapid City, Mb. An area 78 m long x 6 m wide was marked where a solid stand of each weed occurred. The area was then further divided into two 78 x 3 m blocks. One block was kept free of weeds through tillage while the second block was left undisturbed. Thirty-eight barley cultivars, which were locally adapted, were sown in single rows (80 seeds/row) across the two treatments in a randomized fashion with two replicates. The test was allowed to proceed to maturity and plants from each row were harvested individually. A plant count and mean dry weight were obtained for each cultivar for each of the two weed treatments. Replicates were pooled and an ANOVA performed for the means.

RESULTS: As presented in the table. Generally, considerably fewer plants survived in the weed treatment versus fallow treatment. A few cultivars did not have reduced plant counts, including Bonanza in the quackgrass treatment, and BT 379, HB 103, Robust, and TR 133 in the Canada thistle treatment. However, only BT 379 did not show a reduction in biomass. A number of other cultivars in both sets of treatments, also did not show a reduction in biomass but demonstrated a marked reduction in survival. Responses ranged from 0 to 100%.

CONCLUSIONS: There is evidence to suggest that there is the genetic potential for improvement of competitiveness of barley to these two weeds. While it is possible to select for enhanced competitiveness to Canada thistle and Quackgrass, the variability encountered for the trait would also suggest that breeding for enhancement of this trait would be difficult and progress would be slow.

Table 1. Comparison of relative competitiveness of 38 barley cultivars with Quackgrass and Canada thistle.

	Quackgrass						Canada Thistle					
	*Plant count			Mean plant wt.			Piant count			Mean plant wt.		
CULTIVAR	FREE	WEED	%RED	FREE	WEED	%RED	FREE	WEED	%RED	FREE	WEED	%RED
ARGYLE	14.5	4.5	68.9	19.2	3.3	82.8	9.5	2.0	78.9	14.4	2.6	81.9
B1602	4.5	3.0	33.3	9.3	1.6	82.7	15.0	6.5	56.6	12.7	5.5	56.6
BEDFORD	4.0	0.5	87.5	5.1	0.2	96.0	9.0	6.5	27.7	11.3	8.1	28.3
BONANZA	3.5	4.0	0	3.7	1.2	67.5	6.5	5.0	23.0	27.3	10.6	61.1
BRIER	6.0	2.5	58.3	6.6	1.2	81.8	5.5	1.5	72.7	20.3	2.5	87.6
BT_367	4.0	2.5	37.5	12.2	1.3	89.3	10.0	4.0	60.0	13.4	9.5	29.1
BT_377	4.0	1.0	75.0	8.3	1.0	87.9	7.0	6.5	7.1	20.0	19.0	5.0
BT_378	5.5	4.0	27.2	12.0	1.9	84.1	7.5	4.0	46.6	12.0	1.4	88.3
BT_379	10.5	3.0	71.4	8.8	2.8	68.1	6.0	6.5	0	14.6	13.9	4.7
BT_380	4.5	1.0	77.7	9.6	0.6	93.7	11.5	5.5	52.1	9.5	6.6	30.5
BT_433	8.0	3.5	56.2	8.7	4.1	52.8	6.0	1.0	83.3	21.1	1.5	92.8
BT_941	8.5	2.5	70.5	8.7	1.5	82.7	10.0	4.0	60.0	14.6	4.6	68.4
BUCK	9.0	5.5	38.8	13.0	6.3	51.5	8.0	5.5	31.2	12.8	5.6	56.2
BUFFALO	4.5	3.0	33.3	5.0	3.6	28.0	9.0	6.5	27.7	16.2	12.7	21.6
CANDLE	4.5	1.5	66.6	12.1	0.6	95.0	11.0	4.5	59.0	10.6	7.6	28.3
CONDOR	6.0	2.0	66.6	14.9	0.5	96.6	12.5	7.5	40.0	12.6	7.3	42.0
DUKE	6.5	1.5	76.9	13.7	1.1	91.9	9.5	4.0	57.8	13.6	6.3	53.6
EARL	6.5	2.0	69.2	8.2	1.2	85.3	9.0	5.0	44.4	12.6	4.7	62.6
ELLICE	7.5	2.5	66.6	9.1	5.1	43.9	10.5	5.5	47.6	16.4	3.8	76.8
EXCEL	5.0	0.5	90.0	5.0	1.1	78.0	8.0	4.5	43.7	12.1	4.4	63.6
FALCON	10.0	5.0	50.0	7.4	3.3	55.4	7.5	4.0	46.6	13.6	5.1	62.5
HB_103	7.5	2.0	73.3	9.4	1.2	87.2	6.5	8.5	0	19.4	10.6	45.3
HB_104	6.0	1.5	75.0	7.1	2.6	63.3	11.5	5.0	56.5	12.8	6.0	53.1
HB_105	8.5	5.0	41.1	7.1	9.5	0	9.0	3.0	66.6	17.1	2.4	85.9
HEARTLAND	8.0	3.5	56.2	7.7	1.4	81.8	9.5	5.5	42.1	18.2	8.0	56.0
LACOMBE	7.0	3.5	50.0	16.8	22.1	0	10.0	3.0	70.0	15.2	4.0	73.6
LEDUC	9.0	5.0	44.4	7.0	4.1	41.4	7.0	3.5	50.0	13.7	8.2	40.1
MANLEY	7.5	1.5	80.0	9.1	0.6	93.4	9.5	4.5	52.6	18.9	6.9	63.4
OXBOW	7.5	2.0	73.3	11.1	4.7	57.6	8.5	4.5	47.0	10.7	3.7	65.4
ROBUST	9.0	4.5	50.0	16.6	9.8	0	2.5	3.0	0	9.3	2.4	74.1
SILKY	9.0	2.5	72.2	15.1	0.7	95.3	6.0	2.5	58.3	13.9	3.9	71.9
STANDER	10.0	5.0	50.0	10.3	5.1	50.4	8.0	3.5	56.2	18.0	5.8	67.7
TANKARD	7.5	6.0	20.0	12.2	1.9	84.4	7.0	4.0	42.8	13.7	6.9	49.6

TR_133	8.5	5.0	41.1	13.8	1.3	90.5	5.0	6.5	0	21.0	13.3	36.6
TR_229	8.5	7.5	11.7	10.1	3.3	67.3	7.0	4.0	42.8	14.7	8.1	44.8
TR_232	8.5	2.0	76.4	12.0	2.5	79.1	8.5	4.5	47.0	28.2	8.3	70.5
TUPPER	2.0	0.5	75.0	6.9	0.5	92.7	5.5	3.0	45.4	21.5	5.4	74.8
VIRDEN	5.5	0.0	100.0	8.6	0.0	100.0	8.0	4.5	43.7	15.2	5.5	63.8

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* Abbreviations and Legend; wt = weight in grams; Free = free of weeds; weed = containing established weed as indicated; % red = percentage reduction from weed free to weed-infested.

PEST MANAGEMENT METHODS / MÉTHODES DE LUTTE DIRIGÉE

MONITORING METHODS / MÉTHODES DE DÉPISTAGE

Section Editor / Réviseur de section : T. Lysyk

#003 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Cabbage

PEST: Piéride du chou, *Artogeia rapae* (L.) (Lepidoptera: Pieridae);
Fausse-teigne des crucifères, *Plutella xylostella* (L.) (Lepidoptera: Yponomeutidae)

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TITLE: REPRESSION OF *ARTOGEIA RAPAE* (L.) (LEPIDOPTERA: PIERIDAE) AND *PLUTELLA XYLOSTELLA* (L.) (LEPIDOPTERA: YPONOMEUTIDAE) ON FRESH-MARKET AND PROCESSING CABBAGE, USING COMPOSITE ACTION THRESHOLDS FOR CHEMICAL AND BIOLOGICAL CONTROL

MATERIALS AND METHODS: Experiments were conducted at the Agriculture Quebec farm of L'Assomption, Quebec from 1984 to 1988. Fall maturing cabbage seedling cv. Storage Green was transplanted in mid May in every plot, except in 1985 were "Gourmet", a midseason cultivar was used in a second experiment. A plot consisted of eight rows of 12 m, with 45 cm plant spacing. Rows were spaced 1 m apart. Plots were separated from each other by a 4 m base soil buffer.

Treatments, replicated four times in a randomized complete block design, consisted, from 1984 to 1987, of an untreated check, a prophylactic check, treated with insecticide at about weekly intervals and two action thresholds (AT), based on the average infestation in all the replications. The AT was set at 57 and 87% of plants infested with *A. rapae* (ICW) or *P. xylostella* (DB) larvae. In 1984 and 1987, another treatment was added in the experiment. It consisted on application of a cytoplasmic polyhedrosis virus (CPV) in 1984, and of a granulosis virus of *A. rapae* (ArGV) in 1987. Viruses were applied in the respective plots each time the larval population reached 57% in the permethrin plots. Treatment in 1988, also replicated four times, consisted of four different plots: 1. untreated check, 2. a permethrin spray when 57% of the plants were infested with larvae of ICW or DB, 3. a mixture of (1/1) of permethrin and ArGV application, 4. an ArGV spray. Timing for the last two treatments was synchronized with the 57% infestation threshold of the 57% infestation plot.

The chemical insecticide used was permethrin, 140 ml in 750 L of water/ha. Nonylphenoxy polyethoxy at 300 ml/1000 L of spray, was added as a spreader-sticker agent. Permethrin was applied with a tractor-mounted four-row bloom sprayer with drop nozzles adjusted at 1,200 kPa.

A stock suspension of polyhera and granules of *E. scandens* CPV and *A. rapae* GV respectively were applied as aqueous suspension of 10 granules/ha or 10 polyhedra/ha using a compressed-air sprayer (400-500 kPa) with a single-row nozzle. Tween 80 (0.005% vol/vol), chevron (0.025% vol/vol) and skim milk powder (0.5% wt/vol) were included in the viral suspension as wetting, sticker and shade agent respectively.

Damage to cabbage by *A. rapae* and *P. xylostella* was assessed at harvest near the second week of October, except for the cv. Gourmet on 9 September 1985. For each treatment, between 100 and 200 plants were evaluated for market quality.

RESULTS: A summary is presented in Table 1, on marketability of cabbage plants, following different pest management regimes for a fresh as well as a processing crop. An action threshold of 57% of infestation and a prophylactic treatment schedule, produced the same proportion of plants saleable for fresh market ($p > 0.05$). Similarly for processing, no statistical difference could be detected, in the proportion of marketable plants between cabbage from an 87% action threshold and from a plot that received prophylactic treatments. The percentage of plants with uninjured heads is about the same in prophylactic, 57% and 87% infestation plots. CPV of *E. scandens* is ineffective in the control of *A. rapae* larvae. However, ArGV is highly effective against *A. rapae*. There is no statistical difference between viral and prophylactic plots, in the proportion of cabbage marketable for processing. When ArGV is mixed with half a dose of permethrin, the same level of cabbage quality is obtained in both the 57% infestation and the viral plots. The present study indicated that application of ArGV provided a highly effective control of *A. rapae* and could be a good alternative to chemical insecticides for processing cabbage. From a negative binomial series, the action threshold of 57% of infestation corresponds to a population density of about one larva of either *A. rapae* or *P. xylostella* per plant; while the threshold of 87% is equivalent to 3.0 larvae of *A. rapae* and 3.5 *P. xylostella* per cabbage plant.

Table 1. Influence of insecticide-timing treatments on percentage (95% confidence interval) of marketable cabbage plants and uninjured heads in monitored plots at L'Assomption, Québec from 1984 to 1988.

	% of plants marketable for*		% of plants with
Year Plot	Fresh market	Processing	Uninjured head
1984			
Untreated check	2.0(6.2- 0.2)a	20.7(28.9-13.6)a	13.3(20.7- 7.6)a
P**57% infestation	81.3(87.8-72.8)b	93.3(97.0-86.9)b	85.3(91.0-77.3)b
P-87% infestation	58.9(67.7-49.3)b	80.1(86.7-71.5)b	79.5(86.2-70.8)b
P-Prophylactic	78.7(85.5-69.9)b	85.3(91.0-77.3)b	82.0(88.3-73.6)b
Virus CPV	10.7(17.5- 5.6)a	34.0(43.1-25.3)a	22.7(31.1-15.3)a
1985			
Untreated check	27.0(34.6-20.1)	53.5(61.4-45.2)	33.0(40.8-25.5)
Plot 1			
P57% infestation	93.5(96.7-88.2)a	98.0(99.5-94.1)a	93.5(96.7-88.3)a
P87% infestation	89.6(93.7-83.5)a	96.5(98.7-92.1)a	90.1(94.1-84.0)a
P-Prophylactic	100.0(100.0-97.9)a	100.0(100.0-97.9)a	100.0(100.0-97.9)a
1985			
Untreated check	12.4(18.5- 7.6)	27.4(34.9-20.4)	30.3(38.1-23.1)
Plot 2			
P57% infestation	96.5(98.7-92.0)a	97.0(99.0-92.7)a	96.5(98.7-92.0)a
P87% infestation	81.0(86.7-73.8)a	92.5(96.0-87.0)a	82.0(87.5-74.9)a
P-Prophylactic	99.0(99.9-95.6)a	100.0(100.0-97.8)a	99.0(99.9-95.6)a
1986			
Untreated check	5.7(11.1- 2.2)	42.8(51.8-33.7)	29.6(38.2-21.5)
P57% infestation	100.0(100.0-97.4)a	100.0(100.0-97.4)a	100.0(100.0-97.4)a
P87% infestation	95.0(98.0-89.3)a	96.9(99.1-91.8)a	95.6(98.3-90.1)a
P-Prophylactic	98.7(99.9-94.5)a	99.4(100.0-95.5)a	98.7(99.9-94.5)a
1987			
Untreated check	41.0(52.4-29.7)	77.0(85.5-65.7)	43.0(54.4-31.6)
P57% infestation	97.0(99.4-90.0)a	100.0(100.0-95.8)a	97.0(99.4-90.0)a
P87% infestation	84.0(91.1-73.6)ab	96.0(99.0-88.4)a	84.0(91.1-73.6)ab
P-Prophylactic	100.0(100.0-95.8)a	100.0(100.0-95.8)a	100.0(100.0-95.8)a
Virus ArGV (at 57% infestation)	81.0(88.7-70.1)b	95.0(98.5-87.1)a	81.0(88.7-70.1)b
1988			

Untreated check	17.5(27.3- 9.7)	69.9(79.4-58.3)	45.6(56.8-34.2)
P57% infestation	98.0(99.8-91.3)a	100.0(100.0-95.8)a	99.0(100.0-92.9)a
P + Virus ArGV	98.4(99.8-92.9)a	99.2(100.0-94.2)a	99.2(100.0-94.2)a
Virus ArGV	75.0(83.8-63.5)	92.0(96.7-83.1)a	81.0(88.7-70.1)

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* Means within a column, followed by the same letter are not significantly different (P• 0.05) by a Turkey-Kramer multiple comparison test. Data transformed by arcsin• % before analysis.

** P = Plot spray with Permethrin.

#004 REPORT NUMBER / NUMÉRO DU RAPPORT

BASES DE DONNÉES DES ÉTUDES: 335-1252-9506

CULTURE: Carotte, Oignon, Pommier, Maïs sucré

RAVAGEUR: Cercosporose de la carotte (*Cercospora carotae*), charançon de la carotte (*Listronotus oregonensis*), mouche de la carotte (*Psila rosae*), mouche de l'oignon (*Delia antiqua*), pyrale du maïs (*Ostrinia nubilalis*), carpocapse de la pomme (*Laspeyresia pomonella*), mineuse marbrée du pommier (*Lithocolletis blancardella*), mouche de la pomme (*Rhagoletis pomonella*), punaise terne du pommier (*Lygus lineolaris*), tétranyque rouge du pommier (*Panonychus ulmi*), tordeuse à bandes obliques du pommier (*Choristoneura rosaceana*), tordeuse à bandes rouges du pommier (*Argyrotaenia velutinana*), tordeuse du pommier (*Archips argyrospilus*), tavelure du pommier (*Venturia inaequalis*).

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TITRE: IMPLANTATION ET UTILISATION, EN TEMPS RÉEL, DE MODÈLES PRÉVISIONNELS POUR LES MALADIES ET LES INSECTES DANS LES CULTURES MARAÎCHÈRES ET FRUITIÈRES

INTRODUCTION: Plusieurs modèles prévisionnels pour les maladies et les insectes sont actuellement disponibles ou en développement pour les cultures maraîchères et fruitières. Cependant, même si plusieurs intervenants du milieu reconnaissent la pertinence d'utiliser ces outils, seulement quelques modèles parmi ces derniers sont utilisés au Québec. Plusieurs raisons peuvent expliquer cette situation: 1) la disponibilité et la qualité des intrants ne sont pas toujours adéquates, 2) l'utilisation de certains modèles requiert l'achat et l'entretien d'appareils dispendieux, et 3) les modèles ne reproduisent pas toujours la réalité du champ et leur pouvoir prévisionnel est souvent douteux. Suite à une consultation avec différents partenaires, le projet du Centre Informatique de Prévisions des RAvageurs (CIPRA) fut conceptualisé, développé et implanté pour permettre de solutionner les raisons limitant l'utilisation des modèles de prévisions pour les maladies et les insectes dans les cultures maraîchères et fruitières.

CONCEPTUALISATION: Pour répondre aux limites mentionnées précédemment, les solutions suivantes ont été proposées: 1) établir un réseau central informatisé pour faciliter l'accès aux données météorologiques de plusieurs stations automatiques en temps réel, 2) utiliser les prévisions météorologiques pour les prochains jours pour tenter de prévoir les risques de développement des maladies et des insectes, 3) s'assurer d'une calibration uniforme des appareils de mesure aux différentes stations météorologiques automatiques, 4) développer un logiciel informatique permettant d'exécuter tous les modèles prévisionnels à partir de la même banque de données météorologiques, et 5) mettre en place un plan de validation expérimentale et/ou commerciale et de mise à jour des modèles utilisés pour la prévision des maladies et des insectes.

DÉVELOPPEMENT: CIPRA, le Centre Informatique de Prévisions des RAvageurs, est le résultat d'une concertation entre plusieurs institutions pour permettre l'implantation et l'utilisation en temps réel de plusieurs modèles de prévision d'insectes et de maladies dans les culture maraîchères et fruitières dans la province de Québec. L'approche modulaire de l'environnement Windows (langage de programmation Visual Basic) a été privilégiée pour le développement de CIPRA. Les modules de CIPRA sont les suivants: 1) information générale, 2) vérification et correction des données météorologiques, 3) préparation de rapports météorologiques, 4) modèles de prévision de ravageurs dans le pommier (huit insectes et une maladie), 5) modèles de prévision de ravageurs dans les légumes (trois insectes et une maladie), et 6) modèle de prévision dans le maïs sucré (un insecte). CIPRA accède à des données météorologiques standardisées de plusieurs stations automatiques en temps réel. Le module de vérification et de correction des données météorologiques permet, dans un premier temps, d'avertir l'utilisateur des valeurs hors-limites. Ensuite, il est possible de vérifier graphiquement les données météorologiques et de les corriger à l'aide d'un tableau si nécessaire. Le module de préparation de rapports météorologiques permet d'obtenir rapidement des informations de base sur la météorologie comme les données quotidiennes, hebdomadaires et mensuelles, les cumuls thermiques, etc...

IMPLANTATION: Un prototype de CIPRA a été évalué durant l'été 1995 par plusieurs utilisateurs. Suite à une première rencontre officielle avec les utilisateurs de CIPRA en septembre dernier, plusieurs améliorations mineures seront apportées au logiciel en soi, et plusieurs autres modèles prévisionnels seront implantés dans CIPRA pour le début d'avril 1996. Des améliorations seront spécialement apportées au niveau de l'utilisation des prévisions météorologiques et de la prédiction de la mouillure du feuillage. Les différents intervenants ont souligné que plusieurs groupes pourraient bénéficier de l'utilisation des modèles. Les agriculteurs y voient un aspect plutôt économique par la réduction du nombre d'applications de fongicides qui est obtenue en déterminant de façon plus précise les périodes à risque pour le développement de maladies. Les conseillers agricoles y voient un aspect de valeur ajoutée à la qualité et la pertinence de leurs recommandations. Les scientifiques y voient un transfert technologique plus rapide du fruit de leur recherche, et une possibilité de vérification au niveau de la ferme. Les fournisseurs de données y voient une avenue supplémentaire pour justifier la collecte de plus de données et l'amélioration de l'équipement existant. Finalement, les consommateurs de fruits et de légumes, y voient l'achat de produits végétaux avec moins de pesticides qui respectent mieux l'environnement.

PEST MANAGEMENT METHODS / MÉTHODES DE LUTTE DIRIGÉE

SEMIOCHEMICALS / SÉMIOCHIMIQUES

Section Editors / Réviseurs de section :

Insect Pheromones / Phéromones des insects : R. Trimble
Natural Products / Produits naturelles : M. Isman

#005 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv. Ida Red

PEST: Apple maggot, *Rhagoletis pomonella*

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TITLE: EFFICIENCY OF PROTOTYPE BAIT DISPENSERS FOR MONITORING APPLE MAGGOT POPULATIONS IN NOVA SCOTIA APPLE ORCHARDS

MATERIALS: PHEROCON AM® yellow panel baited traps, PHEROCON AM® yellow panel baited traps + Ladd apple volatiles, PHEROCON AM® yellow panel traps baited with slow release Nova Chem formulation, PHEROCON AM traps baited with slow release Nova Chem formulation and Nova Chem apple volatiles and red spheres baited with Ladd Inc. apple volatiles.

METHODS: The test site 'A' was a 1.5 ha block of five year old apple, cv. McIntosh and Ida Red. Site 'B' was a nine year old 2.0 ha block of apple cv. McIntosh'. Traps were hung 1.5 m above ground level on a south east exposure ca. 0.3 m within the tree canopy. Each of the 5 treatments was replicated in a completely randomized design with 8 m between traps within replicates and 16 m between each of the replicates. Traps were deployed 4, July and checked weekly for apple maggot flies. Analysis of variance and separation of the means by Tukey's pairwise comparison was conducted on the mean number of flies caught per trap sample day.

RESULTS: The red spheres captured the greatest numbers of apple maggot flies (Table 1.) in both experiments. The Nova Chem prototype dispenser equalled the capture rate of all but the red sphere (Table 2.) which out performed all trap lure combinations. The action threshold in Nova Scotia is set at one maggot fly and the initial capture of flies with red spheres or yellow panels occurred within the same trapping interval.

CONCLUSIONS: Prototype lure dispensers gave as effective capture rates as did the conventional Pherocon AM commercially used by apple growers.

Table 1. Total trap captures of apple maggot flies on select trap lure combinations over a 50 day trap interval.

Sample date	Pherocon AM® yellow panel				Red sphere
	Nova Chem protein	Nova Chem protein & apple volatile	Pherocon protein	Pherocon protein & Ladd apple volatiles	Ladd apple volatiles
Site 'A'					
July 6	0	1	1	0	13
July 12	2	2	0	4	24
July 19	1	3	0	3	28
July 27	3	10	0	3	15
Aug 2	0	2	1	0	1
Aug 8	2	1	0	0	1
Aug 15	1	0	0	0	2
Aug 22	0	0	0	0	1
Total	9	19	2	10	85
Site 'B'					
July 6	1	0	0	0	5
July 12	2	1	1	3	17
July 19	0	4	1	4	16
July 27	0	4	1	4	4
Aug 2	0	1	2	0	1
Aug 8	0	2	0	0	0
Aug 15	0	1	0	0	0
Aug 22	0	2	0	0	0
Total	3	15	5	11	43

Table 2. Mean (± SE) capture rate per trap day of apple maggot flies.

Trap/Lure	Males	Females	Total (combined sexes)
Site 'A'			
Red sphere & Ladd apple volatiles	1.09 (±.26)a	1.56 (±.36)a	2.66 (±.60)a
Pherocon yellow panel & Nova Chem protein	0.13 (±.06)b	0.16 (±.08)b	0.28 (±.10)b
Pherocon yellow panel & Nova Chem protein & apple volatiles	0.09 (±.07)b	0.50 (±.17)b	0.59 (±.22)b
Pherocon yellow panel and protein	0	0.06 (±.04)b	0.06 (±.04)b
Pherocon card protein & Ladd apple volatiles	0.03 (±.03)b	0.28 (±.14)b	0.31 (±.16)b
Site 'B'			
Red sphere Ladd apple volatiles	0.92 (±.29)a	0.88 (±.31)a	1.79 (±.60)a
Pherocon yellow panel & Nova Chem protein	0.04 (±.04)b	0.08 (±.06)b	0.13 (±.07)b
Pherocon yellow panel Nova Chem protein & apple volatiles	0.29 (±.09)b	0.33 (±.13)ab	0.63 (±.18)b
Pherocon yellow panel and protein	0	0.21 (±.08)b	0.21 (±.08)b
Pherocon yellow panel			

protein & Ladd apple volatiles	0.17 (±.08)b	0.29 (±.13)ab	0.46 (±.18)b

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* For each orchard site, means within a column sharing a common letter are not significantly different P = 0.05, according to Tukey's pairwise comparison.

#006 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Apple, cv. Red delicious, Golden delicious, Spartan

PEST: Fruit tree leafroller, *Archips argyrospila* (Wlk.)

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TITLE: EFFICACY OF AZADIRACHTIN AGAINST FRUIT TREE LEAFROLLER

MATERIALS: NEEM EC (Phero Tech Inc., 20 g AZADIRACHTIN/L, formulated in 1994)

METHODS: The trial was conducted near Kelowna, British Columbia in a 0.29 ha block of 3 - 4 m tall apple trees (3.7 x 4.6 m spacing) planted in eight rows of 18 - 21 trees. Treatments (120 ppm azadirachtin in volumes of 519 and 1038 L/ha) were applied between 0915 and 1015 h on May 12, 1995 using an air-blast orchard sprayer when the trees were in full to late bloom and over 95% of the leafroller larvae had hatched. The 519 L/ha treatment (Treatment A) was applied to the first three rows of trees, the 1038 L/ha treatment (Treatment B) to the next four rows and the last (outside) row was sprayed with water only (Treatment C). The temperature was 16°C, sky overcast; 0.8 mm rain was recorded later in the day but none over the next 2 weeks. On May 24, 50 larval nests were examined per treatment for the presence or absence of live larvae. At the same time, 50 larvae were collected from each plot and returned to the laboratory to assess the impact of the treatments on larval development. Larvae were reared in 4-L plastic pails on leaves gathered from plots from which they were collected. Pupae and dead larvae were removed daily; pupae were placed in separate 30 ml plastic containers in order to record adult and parasite emergence. Dead larvae were discarded. On September 27, 1000 randomly selected apples from ten adjacent trees (100 apples/tree, 50:50 upper:lower canopy) in the centre of each treatment plot were examined for feeding damage by leafroller larvae.

RESULTS: Inspection of larval nests 12 d post-treatment revealed 80, 70 and 74% of the nests contained live larvae in Treatments A, B and C, respectively. Larvae collected from Treatment B were noticeably less active than those from Treatments A and C on May 24 (12 d post-treatment). After 9 d of laboratory rearing, larvae from Treatments A and B were noticeably smaller and less active than larvae from Treatment C. After 12 d rearing (24 d post-treatment), 79% of the larvae from Treatment A and 84% of the larvae from Treatments B had died compared to only 32% from Treatment C. Correcting for mortality among the untreated larvae using a modified Abbott's formula, the mortality was 67% and 74% among larvae from treatments A and B, respectively. Only one larva from treatment B pupated but no adult emerged. One of 10 pupae from the untreated collection failed to develop; the two only pupae from Treatment A collection successfully completed development. No parasites emerged. The proportion of apples damaged as a result of fruit tree leafroller larval feeding was 15.9% (Treatment A), 16.4% (Treatment B) and 11.3% (Treatment C). Overall 55% of the feeding damage occurred in the upper canopy compared to 45% in the lower canopy.

CONCLUSIONS: 120 ppm azadirachtin applied in volumes of 519 and 1038 L/ha using an air-blast orchard sprayer failed to provide any reduction in fruit tree leafroller feeding damage to apple under the conditions of this field study. This conclusion is supported by the lack of efficacy against leafroller larvae based on survivorship 12 d post-treatment. The treatments were applied during full to late bloom which is a favourable time to treat for leafroller larvae. The small amount of precipitation (0.8 mm) should not have reduced residue levels on the leaves. The azadirachtin product used in this study was formulated in the spring of 1994 and stored unopened in a refrigerator until used in this study. No analysis was done to determine if the azadirachtin content of the product had changed over the storage period. The high damage figures and apparent lack of effect on larval survivorship are not consistent with the observed effect in the laboratory of reduced activity and size of larvae exposed to azadirachtin treatments, especially to the higher rate. Larvae that fed upon azadirachtin-treated leaves failed to grow, in fact most shrunk. Less leaf tissue was being consumed by these larvae compared to untreated larvae indicating that the azadirachtin was inhibiting feeding. Therefore the 67 and 74% mortalities among larvae collected from Treatments A and B could be attributed to starvation. Regardless of these laboratory observations, the two rates of azadirachtin, 519 and 1038 L of 120 ppm/ha (equivalent to 62.28 and 124.56 kg/ha), failed to protect apple fruit from attack by fruit tree leafroller larvae. Field trials in the same block in 1994 revealed that 30 ppm, 40 ppm (applied twice) and 60 ppm solutions of azadirachtin applied in 593 L of water/ha will not provide any protection against leafroller feeding.

ENTOMOLOGY / ENTOMOLGIE

FRUIT CROPS / INSECTES DES FRUITS

Section Editors / Réviseurs de section :

Tree Fruits / Arbres fruitiers : R. Smith
Berry Crops / Petits fruit : S. Fitzpatrick

#007 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv. McIntosh

PEST: Codling moth, *Cydia pomonella* (L)

NAME AND AGENCY:
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TITLE: EFFICACY OF SPLIT APPLICATIONS OF CONFIRM 240F AGAINST CODLING MOTH IN NOVA SCOTIA ORCHARDS

MATERIALS: CONFIRM 240F (tebufenozide); COMPANION spreader/sticker; RIPCORD 400EC (cypermethrin)

METHODS: The test site was a 1.5 ha block of ten year old apple, cv. McIntosh. On July 3rd at 250 degree-day heat units after a pheromone trap biofix for first moth capture, a Rhittenhouse orchard mist sprayer delivering a 5x concentration of pesticide at a tank pressure of 1380 kPa was used to treat 0.3 ha with one of the following products (rates are given in product/ha; 1000 ml CONFIRM 240F, 500 ml of CONFIRM 240F with 0.1% (v/v) COMPANION spreader sticker or 250 ml RIPCORD 400EC/ha. On July 10th an additional 500 ml CONFIRM 240F and 0.1% spreader sticker was applied to the previously treated 500 ml CONFIRM plot. The remaining 0.3ha portion of the orchard was unsprayed as a check plot.

On September 1st, fruit injury in all plots was assessed by randomly examining 200 fruit in each plot. Percent damaged fruit was transformed to arcsin prior to analysis of variance and separation of the means by Least Significant Difference T Test (SAS Institute).

RESULTS: Damage levels ranged from a low of 1.0% (split application of CONFIRM) to a high of 9.0% in the untreated check plot. All treatments were equally effective in preventing codling moth damage to the fruit.

CONCLUSIONS: The split application of CONFIRM prove as effective as a single application of CONFIRM or RIPCORD. The single generation of codling moth in Nova Scotia has a relatively short flight interval in most years. This permits effective monitoring and commonly, one application insecticide control give effective results.

Table 1. Comparison of injury levels of apples protected for codling moth damage by applications of CONFIRM 240F or one label rate RIPCORD 400 EC.

Treatment	Product rate/ha	Percent fruit damaged Mean (SEM)*
Unsprayed check	-	9.0 ± 2.28a
RIPCORD 400EC	250 ml	2.0 ± 0.90b
CONFIRM 240F	120 (2 x 500 ml)	1.0 ± 0.69b
CONFIRM 240F	240	4.0 ± 1.30b

* Means within a column sharing a common letter are not significantly different (P = 0.05), according to Least Significant Difference T test.

#008 REPORT NUMBER / NUMÉRO DU RAPPORT

BASE DE DONNÉES DES ÉTUDES: 93000234

CULTURE: Pommier

RAVAGEUR: Charançon de la prune, *Conotrachelus nenuphar* Herbst.

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TITRE: UTILISATION DU NÉMATODE ENTOMOPATHOGÈNE *STEINERNEMA CARPOCAPSAE* POUR LA LUTTE CONTRE LES ADULTES DU CHARANÇON DE LA PRUNE EN VERGERS DE POMMIERS

PRODUITS: BIO-VECTOR (*S. carpocapsae* All)

MÉTHODES: Une parcelle de pommiers nains (cv. McIntosh) de 0.1 ha a été sélectionnée pour les essais. A l'intérieur de la parcelle, 30 arbres ont été choisis au hasard, et 10 arbres ont reçu un des 3 traitements suivants au stade 50% floraison: 1) application de nématodes suivie immédiatement de l'introduction de 10 charançons à la base du tronc; 2) application de nématodes suivie 72 heures plus tard de l'introduction des charançons; 3) application d'eau suivie immédiatement de l'introduction de charançons. La dose de nématodes utilisée a été de 1 million d'individus dans 500 ml d'eau, appliquée sur une surface de 1300 cm carré à la base du tronc de chaque pommier. Le dispositif expérimental choisi était le plan à blocs complets aléatoires à 3 traitements répétés dix fois. Suite aux introduction, des manchons de moustiquaire ont été installés à la base du tronc de chaque pommier, afin de permettre une vérification de la mortalité dix jours plus tard. Des échantillons de sol traité (30 ml) ont été prélevés à tous les 72 heures et mis en présence de larves de *Galleria mellonella* afin de mesurer la persistance du nématode.

RÉSULTATS: Voir tableau ci-dessous.

CONCLUSIONS: Les taux de mortalité obtenus avec le charançon de la prune (85 à 100%) et la persistance du nématode à cet endroit où se regroupent les charançons durant la floraison, nous amènent à conclure à une bonne efficacité du nématode dans ces conditions semi-naturelles. Les essais se poursuivent en parallèle dans des conditions de verger commercial.

Tableau 1.

Traitements	% mortalité charançon après 10 jours			Persistance nématodes dans le sol après				
	n	1993	1995	0jrs	3jrs	4jrs	7jrs	10jrs
Eau	100	15	0	20	0	10	5	0
nématodes 1	100	86	100	100	100	100	68	42
nématodes 2*	100	90	100	-	-	-	-	-

* Introduction des charançons 72 heures après l'application des nématodes.

#009 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Apple, cv. McIntosh

PEST: European red mite, *Panonychus ulmi* (Koch)

NAME AND AGENCY:

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TITLE: BAS-300 11I AIRBLAST APPLICATIONS ON EUROPEAN RED MITE IN APPLES, 1995

MATERIALS: BAS-300 11I (pyridaben 75%); OMITE 30 WP (propargite 30%)

METHODS: A commercial orchard near Carlisle, Ontario was used as the trial site. Treatments were assigned to three tree plots, replicated four times and arranged according to a randomized complete block design. A single application of Apollo had been applied earlier in the season for the control of mite pests. Apple scab was controlled throughout the season with applications of Nova, Nova + Dithane and Dithane cover sprays. Insect pests were controlled with a prebloom application of Decis (for the control of tentiform leafminer) and summer applications of Guthion. The experimental application was made on July 27, 1995, when mite populations had reached approximately 7 to 10 active mites/leaf. European red mites were present in all growth stages when the application was made. Applications were concentrate (see Table 1), using a commercial air blast sprayer calibrated to deliver 1000 L/ha at a sprayer pressure of 2760 kPa (400 psi). Visual phytotoxicity ratings were conducted at -1, 6, 14, 21 and 27 d after treatment (DAT). Efficacy ratings were conducted at the same interval and consisted of mite counts made on 40 whole leaves/tree. Leaves were collected and brushed (using a leaf brushing machine) onto a circular grid pattern for counting. Data were analysed using an analysis of variance and Duncan's Multiple Range Test at the 5% significance level.

Table 1. Treatment list and timing of application for chemical control of European red mites in apples.

Treatment	Rate (g ai/100 L water)	Water Volume (L/ha)	Timing
1. Untreated control	-----	---	---
2. BAS-300 11I 75 WP	7.2	1000	7-10 mites/leaf
3. BAS-300 11I 75 WP	15.0	1000	7-10 mites/leaf
4. OMITE 30 WP	72.0	1000	7-10 mites/leaf

RESULTS: Efficacy data are presented in Tables 2 and 3. There was no visual phytotoxicity to trees in any of the treatments tested.

CONCLUSIONS: All treatments significantly reduced the number of active mites per leaf at 7, 14, 21 and 27 DAT. All chemical treatments provided excellent control of European red mites at this site. There was no significant difference in control between chemical treatments.

Table 2. Response of European red mites to chemical treatments -1, 6 and 14 days after treatment (DAT), 1995.

	Mean Number of Mites/Eggs/Leaf					
	-1 DAT		6 DAT		14 DAT	
Treatment	Mites	Eggs	Mites	Eggs	Mites	Eggs
1*	9.3 a**	134 a	3.8 a	151 a	2.1 a	135 a
2	9.4 a	145 a	0.2 b	165 a	0.1 b	131 a
3	5.7 a	133 a	0.1 b	179 a	0.2 b	106 a
4	6.8 a	157 a	1.0 b	169 a	0.5 b	110 a

** Means followed by the same letter not significant (P = 0.05, Duncan's Multiple Range Test.

* Treatment information is as follows:

1. Untreated control
2. BAS-300 11I 75 WP 7.2 g ai/100 L
3. BAS-300 11I 75 WP 15.0 g ai/100 L
4. OMITE 30 WP 72.0 g ai/100 L

Table 3. Response of European red mites to chemical treatments 21 and 27 days after treatment (DAT), 1995.

	Mean Number of Mites/Eggs/Leaf			
	21 DAT		27 DAT	
Treatment	Mites	Eggs	Mites	Eggs
1*	3.2 a**	116 a	0.6 a	77 a
2	0.9 b	111 a	0.1 b	47 a
3	0.3 b	136 a	0.1 b	51 a
4	0.8 b	119 a	0.2 b	74 a

** Means followed by the same letter not significant (P = 0.05, Duncan's Multiple Range Test.

* Treatment information is as follows:

1. Untreated control
2. BAS-300 11I 75 WP 7.2 g ai/100 L
3. BAS-300 11I 75 WP 15.0 g ai/100 L
4. OMITE 30 WP 72.0 g ai/100 L

#010 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Apple, cv. McIntosh

PEST: European red mite, *Panonychus ulmi* (Koch)
Twospotted spider mite, *Tetranychus urticae* (Koch)
Apple rust mite, *Aculus schlechtendali* (Nalepa)
Predatory mite, *Amblyseius fallacis* (Family Phytoseiidae)

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TITLE: BAS-300 11I AIRBLAST APPLICATIONS ON EUROPEAN RED MITE, TWO SPOTTED SPIDER MITE, APPLE RUST MITE AND BENEFICIAL MITES IN APPLES, 1995

MATERIALS: BAS-300 11I (pyridaben 75% WP); OMITE 30 WP (propargite 30%)

METHODS: A commercial orchard near Carlisle, Ontario was used as the trial site. Treatments were assigned to three tree plots, replicated four times and arranged according to a randomized complete block design. A dormant spray oil had been applied to the trial area for the control of mite pests. Insect pests were controlled with a prebloom application of Decis (for the control of tentiform leafminer) and alternating applications of Guthion (2 applications) and Imidan (3 applications). The grower maintained the crop using standard agronomic practices for control of apple scab. The experimental application was made on July 28, 1995 when twospotted spider mite populations had reached approximately 7 - 10 active mites/leaf and again on August 17, 1995 when twospotted spider mite numbers had reached 30 - 40 active mites/leaf. European red mite and twospotted spider mites were present in all growth stages at each application. Rust mites were observed as active mites only. Applications were concentrate (see Table 1), using a commercial air blast sprayer calibrated to deliver 1000 L/ha at a sprayer pressure of 2760 kPa (400 psi). Efficacy ratings were conducted at -1, 7 and 17 d after the first treatment (DAT) and at 7, 14 and 21 d after the second application. Efficacy ratings consisted of mite counts made on 40 whole leaves/tree. Leaves were collected and brushed (using a leaf brushing machine) onto a circular grid pattern for counting. Data were analysed using an analysis of variance and Duncan's Multiple Range Test at the 5% significance level.

Table 1. Treatment list and timing of application for chemical control of mites in apples.

Treatment	Rate (g a.i./100 L water)	Water Volume (L/ha)	Timing
1. Untreated control	-----	---	---
2. BAS-300 11I 75 WP	7.2	1000	7-10 mites/leaf
3. BAS-300 11I 75 WP	15.0	1000	7-10 mites/leaf
4. OMITE 30 WP	72.0	1000	7-10 mites/leaf

RESULTS: Efficacy data are presented in Tables 2, 3, 4 and 5. There was no visual phytotoxicity to trees in any of the treatments tested.

CONCLUSIONS: European red mite pressure was light. At 17 d after the first application the 15 g ai/100 L rate of BAS-300 11I significantly reduced the number of mites per leaf when compared to the untreated control. A second application was not necessary to control European red mites.

Twospotted spider mite pressure was severe. There was a significant reduction in the number of mites present in treated trees 17 d after the first treatment. All chemical treatments had significantly reduced the number of mites and eggs per leaf. However, all treatments were well above the threshold, and required a second application. After the second application all treatments provided very good control. There was no significant difference between chemical treatments. The increase in the number of mites prior to the second application was likely due to the large number of eggs present at the first application. This suggests that the residual activity of the treatments tested was not sufficient to maintain control of this pest beyond 10 - 14 d in the higher-than-average temperatures experienced during this growing season.

All treatments with the exception of the 7.2 gai/100 L rate of BAS-300 11I provided very good control of a moderate rust mite infestation. A second application was not necessary to control rust mites.

The predatory mite *Amblyseius fallacis* (Family Phytoseiidae), was found in reduced numbers in the trees treated with the highest rate of BAS-300 11I. The number of predatory mites was not significantly different between treated and untreated plots after the second application.

The two rates of BAS-300 11I did not show significantly different control of any of the four mite species present in this test. There was no significant difference in the control provided by the registered standard OMITE 30WP and BAS-300 11I.

Table 2. Response of European red mites to chemical treatments -1, 7 and 17 days after first treatment and 7, 14 and 21 days after second treatment, (DAT) 1995.

	Mean Number of Mites/Eggs/Leaf											
	-1 DAT		7 DAT		17 DAT		7 DAT		14 DAT		21 DAT	
Treatment	(appl. 1)		(appl. 1)		(appl. 1)		(appl. 2)		(appl. 2)		(appl. 2)	
	Mites	Eggs	Mites	Eggs	Mites	Eggs	Mites	Eggs	Mites	Eggs	Mites	Eggs
1**	1.2ab*	1.6a	1.5a	1.6a	2.9a	19.2a	0.0a	0.4a	0.4a	0.5a	0.1a	0.0a
2	2.3ab	5.2a	1.0a	1.3a	1.0ab	3.0a	0.0a	0.2a	0.0b	0.0a	0.0a	0.0a
3	3.1a	4.7a	0.4a	0.4a	0.1b	1.7a	0.0a	0.1a	0.0b	0.2a	0.0a	0.0a
4	1.0b	1.1a	1.3a	0.3a	0.5ab	2.6a	0.0a	0.2a	0.0b	0.2a	0.0a	0.0a

* Means followed by the same letter not significant (P = 0.05, Duncan's Multiple Range Test.

** Treatment information is as follows:
1. Untreated control
2. BAS-300 11I 75 WP 7.2 g ai/100 L water
3. BAS-300 11I 75 WP 15.0 g ai/100 L water
4. OMITE 30 WP 72.0 g ai/100 L water

Table 3. Response of twospotted spider mites to chemical treatments -1, 7 and 17 days after first treatment and 7, 14 and 21 days after second treatment, (DAT) 1995.

	Mean Number of Mites/Eggs/Leaf											
	-1 DAT		7 DAT		17 DAT		7 DAT		14 DAT		21 DAT	
	(appl. 1)		(appl. 1)		(appl. 1)		(appl. 2)		(appl. 2)		(appl. 2)	
	Mites	Eggs	Mites	Eggs	Mites	Eggs	Mites	Eggs	Mites	Eggs	Mites	Eggs
1**	6.4a*	7.1a	12.7a	16.5a	85.0a	179.0a	24.0a	33.4a	26.8a	18.0a	17.8a	1.4a
2	9.0a	26.4a	10.1a	16.7a	37.6b	43.0b	1.9b	3.1b	5.2b	3.0a	1.4b	0.0a
3	15.1a	19.7a	8.0a	14.3a	40.7b	47.0b	1.2b	2.6b	8.1b	7.5a	1.0b	0.0a
4	4.0a	4.5a	8.1a	10.0a	27.2b	30.0b	2.0b	2.3b	2.8b	2.6a	2.4b	0.1a

* Means followed by the same letter not significant (P = 0.05, Duncan's Multiple Range Test.

** Treatment information is as follows:
1. Untreated control
2. BAS-300 11I 75 WP 7.2 g ai/100 L water
3. BAS-300 11I 75 WP 15.0 g ai/100 L water
4. OMITE 30 WP 72.0 g ai/100 L water

Table 4. Response of rust mites to chemical treatments -1, 7 and 17 days after first treatment (DAT), 1995.

Treatment	Rate (g ai/100 L water)	Mean Number of Mites/Leaf -1 DAT (appl. 1)	7 DAT (appl. 1)	17 DAT (appl. 1)
1 Untreated control	---	4.1 a*	1.2 a	3.2 a
2 BAS-300 11I 75 WP	7.2	4.6 a	0.3 b	0.7 ab
3 BAS-300 11I 75 WP	15.0	5.1 a	0.5 b	0.4 b
4 OMITE 30 WP	72.0	3.0 a	0.4 b	0.2 b

* Means followed by the same letter not significant (P = 0.05, Duncan's Multiple Range Test.

Table 5. Response of predatory mites to chemical treatments 17 days after first treatment and 7, 14 and 21 days after second treatment, (DAT) 1995.

Treatment	Rate (g ai/100 L water)	Mean Number of Mites/Leaf *Amblyseius fallacis* 17 DAT (appl. 1)	7 DAT (appl. 2)	14 DAT (appl. 2)	21 DAT (appl. 2)
1 Untreated control	---	2.1 a*	0.4 a	0.0 a	0.3 a
2 BAS-300 11I 75 WP	7.2	0.7 ab	0.1 a	0.1 a	0.0 a
3 BAS-300 11I 75 WP	15.0	0.0 b	0.0 a	0.0 a	0.0 a
4 OMITE 30 WP	72.0	1.2 ab	0.1 a	0.5 a	0.0 a

* Means followed by the same letter not significant (P = 0.05, Duncan's Multiple Range Test.

#011 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 306-1461-9007

CROP: Apple, cv. McIntosh

PEST: European red mite, *Panonychus ulmi* (Koch)

PREDATOR: *Typhlodromus pyri* Scheuten

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TITLE: EFFECTS OF KARATE ON CONTROL OF EUROPEAN RED MITE BY A PYRETHROID-RESISTANT STRAIN OF THE PREDATOR MITE *TYPHLODROMUS PYRI*

MATERIALS: KARATE 50 EC (lambda-cyhalothrin) 6.7 ml product/100 L
KARATE 120 EC (lambda-cyhalothrin) 2.8 ml product/100 L
RIPCORD 400 EC (cypermethrin) 4.17 ml product/100 L

METHODS: All trees tested in this trial had been inoculated the previous summer (25 August 1994) with 50-120 motile stages of a pyrethroid-resistant strain of *T. pyri* originally imported from New Zealand. Transfer was achieved by placing single shoots from *T. pyri*-occupied trees on the foliage of each treated and guard tree in the orchard block. Single-tree plots of 9 yr-old Summerland McIntosh trees on MM111 rootstocks were sprayed to runoff using a truck-mounted lance sprayer at 2800 kPa pressure and a volume of ca 18 L/tree. Eight trees were treated with KARATE 50 EC and eight with KARATE 120 EC when trees were at the pink bud stage (25 May 1995). Four trees were treated with RIPCORD at calyx (12 June 1995) and four other trees were untreated controls. At least two guard trees within a row separated trees having different treatments. Pesticides were diluted to a rate comparable to 3000 L/ha. A precount of ERM winter eggs was taken 11 May 1995 from the 16 trees that were later sprayed with the pyrethroid KARATE. Four 5.0 cm subterminal twigs were taken from each tree and examined for eggs under a binocular microscope. Samples of 25 leaves/tree were taken on the dates shown below and passed through a mite-brushing machine. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 12.5 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for *P. ulmi* were from 1/16th of the plate.

RESULTS: Pretreatment counts of *P. ulmi* winter eggs were high, averaging 184 eggs /20 cm of wood, indicating the potential for explosive growth of *P. ulmi* unless they were suppressed by predators. There were some significant variations among summer eggs of *P. ulmi* in early summer (Table 1). However, treatment means for motile *P. ulmi* did not differ until mid-July and treatment means for *T. pyri* did not differ until early August. Motile *P. ulmi* reached highest counts in early August and then stabilized (KARATE 120 plots) or declined by mid-August due to increasing predation by *T. pyri*. The 1st-15th August decline of *P. ulmi* was strongest in the RIPCORD plot. By mid-August, populations of *T. pyri* in all plots were high enough to significantly affect *P. ulmi* counts despite previous applications of KARATE or RIPCORD.

CONCLUSIONS: The pyrethroids KARATE and RIPCORD were applied in early summer 1995 on trees heavily-infested with *P. ulmi* and at a time when *T. pyri* were just starting to get established on the trees. (Extensive research in Nova Scotia and elsewhere indicates *T. pyri* requires 1 - 2 years to get well enough established on trees to give effective control of *P. ulmi*). Nonetheless, by August 1995 predator populations were able to stabilize or reduce densities of *P. ulmi*. Thus the data suggests that both RIPCORD and KARATE are compatible with biological control of *P. ulmi* by pyrethroid-resistant *T. pyri*.

Table 1. Means for number of mites/leaf on 4 - 8 McIntosh apple trees per treatment. Means in the same column followed by the same letter are not different according to Tukey's Studentized range test after square root transformation of the data. Symbols: RME, RM- summer eggs and motile stages of *P. ulmi*; TP- motile stages of *T. pyri*.

	19 June			26 June		
Treatment	RME	RM	TP	RME	RM	TP
Control	10.80a	0.80b	0.00a	10.21ab	5.41a	0.10a
KARATE 120 EC	2.70b	0.30bc	0.00a	2.63b	0.71a	0.03a
KARATE 50 EC	6.39ab	0.10c	0.08a	9.61ab	2.60a	0.08a
RIPCORD	15.00a	2.60a	0.00a	20.80a	6.40a	0.00a

	7 July			14 July		
Treatment	RME	RM	TP	RME	RM	TP
Control	10.21ab	5.42a	0.10a	14.96ab	3.17b	0.11a
KARATE 120 EC	2.23b	1.33a	0.05a	5.06bc	1.90b	0.05a
KARATE 50 EC	7.39ab	8.00a	0.00a	2.90c	0.70b	0.03a
RIPCORD	20.80a	6.40a	0.00a	35.80a	13.00a	0.00a

	1 August			15 August		
Treatment	RME	RM	TP	RME	RM	TP
Control	65.80a	24.80a	1.80a	36.35ab	15.95ab	2.46a
KARATE 120 EC	42.70ab	22.10a	0.31b	45.31a	24.83ab	0.56b
KARATE 50 EC	45.80ab	40.40a	0.21b	62.90a	31.70a	0.75b
RIPCORD	24.80b	31.80a	0.46ab	8.00b	2.80b	0.93ab

#012 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 306-1461-9007

CROP: Apple, cv. Red Delicious

PEST: European red mite, *Panonychus ulmi* (Koch)
Apple rust mite, *Aculus schlechtendali* (Nalepa)

PREDATORS: *Typhlodromus pyri* (TP) Scheuten

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TITLE: CONTROL OF EUROPEAN RED MITE WITH PYRIDABEN AND COMPATIBILITY WITH *TYPHLODROMUS PYRI*

MATERIALS: BASF 300 11 I 75 WP (pyridaben) 9.6 g product and 20.0 g product/100 L;
APOLLO 500 SC (clofentezine) 20.0 ml/100 L;
KELTHANE 35 WP (dicofol) 150 g/100 L; OMITE 30 WP (propargite) 225 g/100 L

METHODS: Four single-tree plots of mature Red Delicious trees were sprayed to runoff used a truck-mounted lance sprayer at 2800 kPa pressure and a volume of ca 15 L/tree. The early APOLLO treatment was applied at the pink bud stage of tree development (20 May 1994). All other treatments were applied at first cover (23 June). Pesticides were diluted to a rate comparable to 3000 L/ha. A precount of ERM winter eggs was taken 11 May 1994 for all trees except those treated with APOLLO 23 June. Four 5.0 cm subterminal twigs were taken from each tree and examined for eggs under a binocular microscope. Samples of 25 leaves/tree were taken on the dates shown below and passed through a mite-brushing machine. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 12.5 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factors of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for other mites were from 1/16th of the plate.

RESULTS: There were significant differences in pretreatment counts of *P. ulmi* winter eggs among the different treatments with the KELTHANE-treated trees and those later sprayed with the lower rate of pyridaben (BASF low, 9.6 g/100 L) being the most heavily infested and the APOLLO 20 May and control trees having significantly fewer winter eggs (Table 1). Mite-days, the product of the mean number of motile *P. ulmi* per leaf and the time interval between successive sampling dates, gives a useful index of mite injury through the growing season. I did an analysis of covariance, to test the effects of miticide treatment and winter eggs on the total number of mite-days from 22 June to 31 August. Treatment had a significant influence but winter eggs did not. Therefore all further analyses were a simple one way analysis of variance. All treatments except KELTHANE caused a significant reduction in mite injury (indicated by cumulative mite-days) compared with the control (Table 1). Both treatments with pyridaben were significantly more effective than those with APOLLO or OMITE. *T. pyri* is known to be an effective natural enemy of *P. ulmi* and *A. schlechtendali*. By August, when *T. pyri* were abundant enough for accurate statistics, it was evident that all treatments including pyridaben allowed these predators to exert control on *P. ulmi* and *A. schlechtendali* (Table 2). Pyridaben gave season-long control of *P. ulmi*: there were always <6 active stages/leaf. Numbers in the 20 May APOLLO plot reached 15.2 active mites on 8 August, but numbers declined thereafter. There was no evidence of phytotoxicity caused by any of the treatments including pyridaben. The 23 June APOLLO treatment allowed damaging numbers of red mite in July (counts >10 on 6, 14 and 28 July) but in August *T. pyri* caused a steady decline in red mite numbers. Conversely OMITE suppressed red mite through June and most of July but in August numbers were high and damaging until the end of the month. With KELTHANE mite suppression was only adequate for a few weeks until 14 July. *A. schlechtendali* numbers were low in all plots until mid-July, 3 week after treatment. By 19 July counts in the plots treated with KELTHANE and the higher rate of pyridaben had fewer *A. schlechtendali* than did the control since counts in other treatments were not lower. Later counts were strongly affected by increasing numbers of *T. pyri*.

CONCLUSIONS: The 20 May APOLLO treatment and both 23 June pyridaben treatments coupled with *T. pyri* gave effective control of *P. ulmi* compared with the untreated control. APOLLO on 23 June was less effective but permitted high survival of *T. pyri* which by August caused a steady decline in *P. ulmi* numbers. OMITE and KELTHANE were less effective in suppressing *P. ulmi*. KELTHANE is reported to be moderately toxic to *T. pyri* and this may have permitted counts of *P. ulmi* to increase more than with the other treatments.

Table 1. Number of *P. ulmi* winter eggs on four 5cm lengths of wood per Red Delicious tree sampled 11 May 1994 and mite-days per leaf accumulated from June 22 to August 31, 1994. Means in the same column followed by the same letter are not different according to the Waller-Duncan K ratio t test after square root transformation of the data.

Treatment	Dosage /100 L	Winter eggs	Mite-days /leaf	No. of trees
APOLLO 23 June	20.0 ml		700.80 c	4
APOLLO 20 May	20.0 ml	146.25 c	366.80 d	4
BASF high	20.0 g	252.75 b	114.70 e	4
BASF low	9.6 g	283.50 ab	192.30 de	4
Control		89.00 d	2143.40 a	4
KELTHANE	150 g	296.50 a	1743.00 a	4
OMITE	225 g	214.75 b	1214.70 b	4

Table 2. Means for number of mites/leaf on Red Delicious apple trees treated to runoff 20 May (one APOLLO treatment only) or 23 June 1994 (all other treatments). Means in the same row followed by the same letter are not different according to the Waller-Duncan k ratio t test after square root transformation of the data. Symbols: RME, RMN, RMA- eggs, nymphs and adults of European red mite; ARM- motile stages of apple rust mite; TPM- motile stages of *T. pyri*.

22 June 1994

	APOLLO 23 June	APOLLO 20 May	BASF high	BASF low	Control	KELTHANE	OMITE
RME	42.00 a	0 d	8.60 bcd	16.20 abc	2.60 cd	16.00 ab	5.20 bcd
RMN	4.20 a	0 b	0.40 ab	2.60 ab	0.00 b	1.20 ab	0.80 ab
RMA	0.00 b	0 b	0.00 b	0.60 a	0.00 b	0.40 ab	0.20 ab
ARM	0.00 a	0 a	0.00 a	0.00 a	0.00 a	0.20 a	0.00 a
TPM	0.00 a	0 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a

29 June 1994

	APOLLO 23 June	APOLLO 20 May	BASF high	BASF low	Control	KELTHANE	OMITE
RME	17.20 a	0 d	4.20 bc	7.80 b	0.60 cd	8.00 b	5.20 b
RMN	2.40 ab	0 b	0.20 ab	5.20 ab	0.80 ab	4.60 a	3.00 ab
RMA	6.00 a	0 c	0.00 c	0.00 c	0.80 bc	2.00 b	0.20 c
ARM	0.00 a	0 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
TPM	0.00 a	0 a	0.00 a	0.05 a	0.00 a	0.00 a	0.05 a

6 July 1994

	APOLLO 23 June	APOLLO 20 May	BASF high	BASF low	Control	KELTHANE	OMITE
RME	133.20 a	1.40 c	2.80 c	4.20 c	38.20 b	54.20 b	2.00 c
RMN	5.00 a	0.20 b	0.20 b	0.60 b	1.20 b	1.00 b	0.60 b
RMA	13.80 a	0.20 c	0.00 c	0.80 c	3.60 b	5.60 b	0.40 c
ARM	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
TPM	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.05 a

14 July 1994

	APOLLO	APOLLO	BASF	BASF			
	23 June	20 May	high	low	Control	KELTHANE	OMITE
RME	252.20 a	16.20 d	5.00 d	12.80 d	69.60 c	150.00 b	9.20 d
RMN	4.60 a	1.20 b	0.00 b	1.40 b	8.40 a	5.80 a	0.40 b
RMA	4.40 b	0.40 d	0.00 d	0.60 cd	2.00 c	9.40 a	0.20 d
ARM	1.40 a	4.20 a	0.80 a	1.20 a	9.60 a	3.20 a	0.80 a
TPM	0.00 b	0.00 b	0.00 b	0.11 a	0.00 b	0.00 b	0.00 b

19 July 1994

	APOLLO	APOLLO	BASF	BASF			
	23 June	20 May	high	low	Control	KELTHANE	OMITE
RME	150.80 a	12.20 b	2.20 b	6.20 b	72.80 a	118.60 a	18.60 b
RMN	19.20 a	0.40 b	1.00 b	0.80 b	20.00 a	5.40 ab	2.00 b
RMA	6.60 abc	1.80 bc	0.20 c	1.60 bc	9.40 ab	16.40 a	3.80 bc
ARM	12.60 abc	34.40 ab	4.80 c	16.00 abc	44.00 a	7.20 bc	8.00 abc
TPM	0.00 b	0.11 a	0.00 b	0.00 b	0.00 b	0.00 b	0.00 b

28 July 1994

	APOLLO	APOLLO	BASF	BASF			
	23 June	20 May	high	low	Control	KELTHANE	OMITE
RME	33.40 b	18.40 b	2.20 c	4.00 c	81.60 a	64.40 a	23.80 b
RMN	1.80 c	0.60 cde	0.20 e	0.40 de	7.40 a	5.00 b	1.40 cd
RMA	10.20 c	5.00 cd	1.40 d	1.20 d	39.40 a	27.60 b	9.00 c
ARM	5.60 b	11.00 a	0.60 c	2.40 c	8.80 ab	9.20 ab	0.40 c
TPM	0.16 a	0.26 a	0.05 a	0.05 a	0.26 a	0.11 a	0.05 a

3 August 1994

	APOLLO	APOLLO	BASF	BASF			
	23 June	20 May	high	low	Control	KELTHANE	OMITE
RME	103.40 b	23.40 cd	4.40 e	11.60 de	148.80 a	51.20 bc	150.40 a
RMN	3.40 bc	1.20 c	0.20 c	1.60 bc	12.40 a	4.40 bc	6.00 ab
RMA	3.60 c	2.40 c	0.20 c	1.40 c	47.00 a	17.60 b	21.00 b
ARM	24.40 a	5.20 b	4.20 b	5.40 b	30.60 a	5.60 b	18.00 a
TPM	0.72 abc	1.34 ab	0.31 c	0.41 c	1.39 a	0.26 c	0.57 bc

8 August 1994

	APOLLO	APOLLO	BASF	BASF			
	23 June	20 May	high	low	Control	KELTHANE	OMITE
RME	59.60 bc	50.80 c	7.20 d	7.20 d	89.80 ab	104.80 a	85.00 ab
RMN	5.80 b	4.80 b	0.20 c	0.40 c	15.40 a	16.00 a	6.20 b
RMA	7.20 cd	10.40 c	1.80 de	0.80 e	73.00 a	70.20 a	29.80 b
ARM	23.00 b	13.20 cd	17.00 bc	7.60 d	54.20 a	41.80 a	28.40 b
TPM	0.72 ab	1.08 a	0.41 bc	0.36 c	0.72 ab	0.36 c	0.52 bc

15 August 1994

	APOLLO	APOLLO	BASF	BASF			
	23 June	20 May	high	low	Control	KELTHANE	OMITE
RME	8.20 bc	21.60 ab	6.80 bc	5.60 bc	10.60 bc	16.00 bc	38.00 a
RMN	1.60 cd	4.20 bc	1.00 cd	0.20 d	20.80 a	18.00 a	5.80 b
RMA	2.40 b	5.40 b	2.20 b	1.40 b	36.40 a	4.40 b	38.80 a
ARM	19.40 ab	22.60 ab	9.40 ab	4.80 b	41.60 a	11.20 ab	28.40 a
TPM	0.98 ab	1.70 a	0.36 b	0.31 b	1.13 a	0.26 b	0.26 b

24 August 1994

	APOLLO	APOLLO	BASF	BASF			
	23 June	20 May	high	low	Control	KELTHANE	OMITE
RME	3.00 e	20.40 ab	3.00 e	10.20 cd	5.20 de	13.80 bc	24.60 a
RMN	0.40 c	4.20 b	1.40 bc	3.20 b	3.60 b	9.20 a	9.40 a
RMA	0.60 d	7.40 bc	2.60 cd	1.60 cd	15.60 ab	28.00 a	26.40 a
ARM	4.60 c	19.40 ab	3.20 c	20.20 ab	26.00 a	10.40 bc	26.00 a
TPM	1.55 ab	2.32 a	0.67 bc	0.88 bc	1.70 ab	0.72 bc	0.36 c

31 August 1994

	APOLLO	APOLLO	BASF	BASF			
	23 June	20 May	high	low	Control	KELTHANE	OMITE
RME	0.60 c	7.40 a	6.40 ab	6.80 a	1.80 bc	7.60 a	8.80 a
RMN	0.20 ab	1.80 ab	1.00 ab	2.80 a	0.00 b	0.80 ab	2.00 ab
RMA	0.00 c	2.60 bc	4.20 bc	2.20 c	1.00 c	8.00 ab	12.60 a
ARM	0.00 d	1.80 bc	1.20 bcd	0.20 cd	3.60 ab	5.00 a	2.40 ab
TPM	1.34 b	3.56 a	0.67 b	1.03 b	1.45 b	0.98 b	1.08 b

#013 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 91000658

CROP: Apple, cv. McIntosh

PEST: European red mite, *Panonychus ulmi* (Koch)
Two-spotted spider mite, *Tetranychus urticae* (Koch)

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TITLE: EVALUATION OF BAS-300 11 I FOR THE CONTROL OF EUROPEAN RED MITE AND TWO-SPOTTED SPIDER MITE IN APPLES, 1995

MATERIALS: BAS-300 11 I (BAS-300)-75 WP (pyridaben); KELTHANE 35 WP (Dicofol); OMITE 30 WP (Propargite); SUPERIOR OIL 72; APOLLO 500 SC (clofentezine); MORESTAN 25 WP (chinomethionat)

METHODS: The trial was established in a 25-year old block of McIntosh trees on MM-106 rootstock, spaced 1.83 m x 4.45 m, using a R.C.B. design with five-tree plots and four replicates. Applications were made with a diaphragm-pump, hand-gun system, operating at 1360 kPa, and were made on a spray to runoff basis. A full dilute rate of 3000 L/ha was assumed and treatment mixes were diluted on this basis. BAS-300 was to be evaluated as a contact miticide against adults and nymphs. Applications were to be made at two rates, each rate to be examined as an individual treatment and in a program following an oil application. Commercially used standard miticides were included for comparative purposes in the evaluation of product effectiveness. Later applications of BAS-300, would be made where the commercial standards no longer provided satisfactory control, thus giving supplementary information on the "knock-down" capabilities of this adulticide product.

TREATMENT SCHEDULE: Oil applications were made on May 5 (green-tip), MORESTAN was applied May 16 (pink) and the APOLLO treatment was made on May 30 (late calyx). All other treatments were to be applied when the mite populations reached problematic levels, using the predominating weather conditions and a population threshold of 7-10 active mites/leaf as general guidelines. These criteria resulted in: BAS-300 being applied on June 16 in Treatments 2 and 3 in the stand-alone program and in Treatment 8 as a follow-up to MORESTAN; OMITE being applied in Treatment 6 on June 23 as a follow-up to the oil; BAS-300 being applied on Treatments 4 and 5 on June 27 as follow-up applications to oil. On July 21, BAS-300 was applied as a sequential treatment to APOLLO in Treatment 7. KELTHANE was applied as a follow-up to OMITE in Treatment 6.

PRE-TREATMENT MITE COUNT INFORMATION: The plot area was monitored on a weekly basis, prior to the initiation of treatments, to determine the average number of active mites present per leaf. On June 1, using a 6 leaf sample per plot, there was just under 1 mite/leaf in the treatments that had received an oil application, the treatments where no applications had yet been made had between 4.5 - 5.5 active mites/leaf, and the MORESTAN treatment had 3 mites/leaf. On June 8, again using a 6 leaf sample per plot, the treatments where no applications had yet been made had between 2.25 active mites/leaf, and the MORESTAN treatment had just over 1 mite/leaf. The June 15 counts, presented in the first column of Tables 1 and 2, indicate the increased activity of both mite species that triggered the first series of BAS-300 applications. From this point forward, the combined counts presented in the two tables were used for making the application timing decisions described above in the TREATMENT SCHEDULE section.

ASSESSMENTS: At each sampling, 15 leaves of uniform age and size were collected and passed through a leaf brushing machine. Plate counts of the adults and nymphs present leaf were made using a binocular microscope, and were converted back to a per leaf basis for presentation in the tables below.

RESULTS: As presented in the table.

DISCUSSION: Both rates of BAS-300 provided excellent season-long control of the heavy ERM population. This was the case, both where the product was the only one used, and where it was a follow-up to an oil application. These oil applications had the effect of delaying the requirement for the BAS-300 treatments by 11 d. Under the high mite pressure present, the MORESTAN and APOLLO treatments failed to provide the sustained control; the APOLLO treatment had been followed by a heavy shower within 15 min of the application. The knock-down applications of BAS-300 over these two treatments brought the mite populations under control for the balance of the season. The oil/OMITE/KELTHANE program offered a sustained suppression of the mite populations, but there was a level of leaf bronzing that clearly allowed this treatment to be distinguished from the BAS-300 treatments, where the foliage remained lush green. The foliage in the untreated control plots was completely bronzed by the end of July, and the mite populations fell to near zero by mid-August (counts not shown). In almost all instances, significant differences were seen between the greatly reduced mite populations of the BAS-300 treated plots and the populations of untreated control and the commercial standards.

Table 1. European red mite: adults and nymphs per 15 leaf sample.*

Treatment	Rate g a.i./ 100 L	Appl. Dates	EUROPEAN RED MITE PER LEAF COUNTS					
			15/06	22/06	27/06	10/07	18/07	24/07
1.Control	-	-	19.5a	21.3a	17.0a	28.3a	14.0a	4.2a
2.BAS-300	7.2	16/06	9.1bc	1.8c	0.9d	0.5c	0.9d	1.0cd
3.BAS-300	15.0	16/06	9.4b	1.4c	1.0d	0.6c	0.8d	0.3d
4.Sup. Oil +	65 L/ha	05/05						
BAS-300	7.2	27/06	2.0c	7.6b	4.3bc	1.1c	0.6d	0.7cd
5.Sup. Oil +	65 L/ha	05/05						
BAS-300	15.0	27/06	2.6bc	4.8bc	5.1b	0.8c	0.6d	0.3d
6.Sup. Oil +	65 L/ha	05/05						
OMITE +	79.0	23/06						
KELTHANE	60.0	27/06	3.2bc	8.3b	2.2cd	3.6b	4.6c	5.7a
7.APOLLO +	300.0	30/05						
BAS-300	15.0	21/07	3.0bc	3.4bc	5.8b	5.2b	8.6b	1.9c
8.MORESTAN +	31.3	16/05						
BAS-300	7.2	16/06	5.8bc	1.1c	0.5d	0.6c	1.1d	0.9cd

* In each column, means followed by same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test).

Table 2. Two-spotted spider mite: adults and nymphs per 15 leaf sample.*

Treatment	Rate g a.i./ 100 L	Appl. Dates	TWO-SPOTTED SPIDER MITE PER LEAF COUNTS					
			15/06	22/06	27/06	10/07	18/07	24/07
1.Control	-	-	5.9a	2.2a	1.3a	3.5a	1.1a	0.6a
2.BAS-300	7.2	16/06	4.6ab	0.2bc	0.3b	0.3b	0.3b	0.7b
3.BAS-300	15.0	16/06	2.7bc	0.2bc	0.2b	0.3b	0.4b	0.3b
4.Sup. Oil +	65 L/ha	05/05						
BAS-300	7.2	27/06	0.9c	0.9b	0.6b	0.2b	0.1b	0.2b
5.Sup. Oil +	65 L/ha	05/05						
BAS-300	15.0	27/06	0.9c	0.8bc	0.5b	0.3b	0.3b	0.4b
6.Sup. Oil +	65 L/ha	05/05						
OMITE +	79.0	23/06						
KELTHANE	60.0	27/06	1.0c	0.9b	0.6b	0.7b	1.0a	1.5a
7.APOLLO +	300.0	30/05						
BAS-300	15.0	21/07	0.7c	0.4bc	0.6b	1.0b	1.2a	0.3b
8.MORESTAN +	31.3	16/05						
BAS-300	7.2	16/06	1.9bc	0.1c	0.2b	0.2b	0.3b	0.3b

* In each column, means followed by same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test).

#014 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv. McIntosh

PEST: Fall webworm, *Hyphantria cunea* (Drury), Lepidoptera: Arctiidae

NAME AND AGENCY:

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TITLE: EFFICACY OF CONFIRM 240F (TEBUFENOZIDE) AGAINST FALL WEBWORM IN NOVA SCOTIA ORCHARDS

MATERIALS: CONFIRM 240F (tebufenozide); COMPANION spreader/sticker; IMIDAN 50 WP (phasmid)

METHODS: The source population of fall webworm was collected from a research test orchard comprised of cv. `McIntosh', August 5th 1995. Larvae were removed from their webs and placed, 10/petr. dish, on apple leaves treated with one of three solutions: water only (check), IMIDAN 50 WP at 4.12 kg or CONFIRM 240F with 0.1% (v/v) COMPANION spreader sticker at 1000 ml/ha. There were 10 replicates per treatment. After 3 d, fresh pesticide free leaves were added to sustain the larvae. Mortality was assessed at 2-3 d intervals for ca 21 d.

Analysis of variance and separation of the means was by Least Significant Difference T Test (SAS Institute).

RESULTS: CONFIRM quickly gave 100% mortality and treated leaves were fed upon for only 1 d; bioactivity was faster than that of IMIDAN. There was some (5-10%) parasitism of webworm larvae from an unidentified braconid. Successful emergence of this parasite averaged 74% in the check and 29% in IMIDAN and 67% in the CONFIRM treatment.

CONCLUSIONS: The laboratory petr. dish tests strongly suggest that the moult accelerating compound, CONFIRM 240F would have merit in orchard pest management, even as spot treatments where fall webworm and related species occur.

Table 1. Comparison of mortality levels of fall webworm larvae fed leaves treated (n = 100 larvae) with 1000 ml/ha of CONFIRM 240F or 4.12 kg/ha of IMIDAN 50 WP.

Treatment	Days post-treatment	Mean (SEM)*
Unsprayed check	3	0 ± 0a
CONFIRM 240F	3	0 ± 0a
IMIDAN 50 WP	3	0 ± 0a
Unsprayed check	5	10.0 ± 1.0a
CONFIRM 240F	5	100.0 ± 0b
IMIDAN 50 WP	5	25.0 ± 3.4c
Unsprayed check	7	26.0 ± 7.0a
CONFIRM 240F	7	100.0 ± 0b
IMIDAN 50 WP	7	49.0 ± 8.5c
Unsprayed check	10	35.0 ± 5.4a
CONFIRM 240F	10	100.0 ± 0b
IMIDAN 50 WP	10	83.0 ± 3.80c

* Means within the same post-treatment day (column) sharing a common letter are not significantly different (P = 0.05), according to Least Significant Difference T test (SAS Institute 1989.

#015 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv. McIntosh

PEST: Spotted tentiform leafminer, *Phyllonorycter blancardella (Fabricius)*

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TITLE: EFFICACY OF CONFIRM 240F (TEBUFENOZIDE) AGAINST SPOTTED TENTIFORM LEAFMINER POPULATIONS AND POTENTIAL WITHIN IPM OF NOVA SCOTIA APPLE ORCHARDS

MATERIALS: CONFIRM 240F (tebufenozide); COMPANION (spreader/sticker); CYGON 480EC (dimethoate)

METHODS: The test site was a 3.0 ha block of apple, cv. 'McIntosh'. The area was divided into ca. 1.0 ha units each receiving one of the following applications of insecticide on June 9th 1995; CONFIRM 240F at 240 g a.i./ha + COMPANION at 0.1% v/v, CONFIRM 240F at 120 g a.i./ha and COMPANION at 0.1% v/v both on June 9th and again on June 19th, CYGON 480E 1.6 L a.i./ha. Products were applied with a orchard mist sprayer delivering a 5x concentration of pesticide at a tank pressure of ca. 1300 kPa. Pre-treatment counts of leafminer eggs were taken, in addition to twenty randomly chosen fruit spur clusters per plot sampled at two week intervals on six occasions. Dissected mines were examined for larval mortality and rate of parasitism. Analysis of variance and separation of the means by Tukey's pairwise comparison was conducted on the mean values, which were transformed, where appropriate prior to analysis.

RESULTS: Pre-spray counts revealed 0.60±.16, 1.6±.36 and .74±.17 leafminer eggs per fruit spur cluster (mean±SE) for the CYGON, CONFIRM full rate and CONFIRM split application, respectively. On June 19th leaves suffering presence of mines were 16.6%, 14.9% and 18.1% for CYGON, CONFIRM full rate and CONFIRM split application, respectively, indicating a potentially troublesome population increase.

Table 1a. Mean* seasonal abundance of spotted tentiform leafminers and associated parasites. (mean ± SE) per fruit spur cluster (n + 20) in plots treated June 9th 1995. Values are for the interval July 5th through August 29th 1995.

	Leafminer life stage			Parasite life stage		
	eggs	mines	sap feeder		tissue feeder	
		alive	dead	alive	dead	
CYGON	4.1±.49a	4.2±.24a	14.6±1.4a	3.4±.51a	1.5±.23a	2.9±.41a
CONFIRM full rate	1.9±.29b	2.9±.17b	5.4±.77b	3.4±.44a	.68±.12b	1.0±.15b
CONFIRM two 50 % rate	4.0±.74a	3.5±.22a	8.9±1.1b	5.4±.86a	.56±.14b	1.2±.19b

* Means within a column sharing a common letter are not significantly different (P = 0.05) according to Tukey's LSD test (SAS 1989).

Table 1b. (continued from 1a). Mean* seasonal abundance of spotted tentiform leafminers and associated parasites.
(mean ± SE) per fruit spur cluster (n + 20) in plots treated June 9th 1995. Values are for the interval July 5th through August 29th 1995.

	Parasite life stage		
	chalcids	braconids	percent parasitism
CYGON	2.5±.31a	.67±.13a	16.2±2.1a
CONFIRM full rate	.87±.12b	.22±.06b	10.1±1.6a
CONFIRM two 50% rate	.90±.13b	.29±.07b	13.7±3.1a

* Means within a column sharing a common letter are not significantly different (P = 0.05) according to Tukey's LSD test (SAS 1989).

Table 2a. Mean* seasonal abundance of spotted tentiform leafminers and associated parasites. (mean ± SE) per fruit spur cluster (n = 20) in plots treated June 9th 1995. Values are for samples taken on July 5th 1995.

	Leafminer life stage				Parasite life stage	
	eggs	mines	sap feeder		tissue feeder	
			alive	dead	alive	dead
CYGON	0 ±0a	2.2±.33a	.70±0.20a	.35±.15a	.20±.09a	.35±.17a
CONFIRM full rate	0 ±0a	2.1±.41a	.30±.11b	3.4±.44a	.40±.13a	.10±.07a
CONFIRM two 50% rate	0 ±0a	2.7±.62a	.30±0.10b	5.4±.86a	.30±.11a	40±.15a

* Means within a column sharing a common letter are not significantly different (P = 0.05) according to Tukey's LSD test (SAS 1989).

Table 2b (continued from 2a). Mean* seasonal abundance of spotted tentiform leafminers and associated parasites.
(mean ± SE) per fruit spur cluster (n = 20) in plots treated June 9th 1995. Values are for samples taken on July 5th 1995.

	Parasite life stage		
	chalcids	braconids	percent parasitism
CYGON	.10±.07a	.30±.11a	25.0±9.1a
CONFIRM full rate	.25±.10a	0 ± 0 b	12.6±7.2a
CONFIRM two 50% rate	.10±.07a	0 ± 0 b	13.3±9.1a

* Means within a column sharing a common letter are not significantly different (P = 0.05) according to Tukey's LSD test (SAS 1989).

Table 3a. Mean* seasonal abundance of spotted tentiform leafminers and associated parasites. (mean ± SE) per fruit spur cluster (n = 20) in plots treated June 9th 1995. Values are for samples taken July 19th 1995.

	Leafminer life stage				Parasite life stage	
	eggs	mines	sap feeder		tissue feeder	
			alive	dead	alive	dead
CYGON	8.6±1.3a	6.8±.70a	3.0±.57a	1.3±.26a	.30±.16a	1.5±.38a
CONFIRM full rate	3.9±.75b	5.3±.57a	1.6±.32b	1.8±.37a	.05±.05a	.45±.17b
CONFIRM two 50% rate	4.9±.93b	5.2±.82a	.90±.30b	1.5±.34a	.05±.05a	.55±.22b

* Means within a column sharing a common letter are not significantly different (P = 0.05) according to Tukey's LSD test (SAS 1989).

Table 3b (continued from 3a). Mean* seasonal abundance of spotted tentiform leafminers and associated parasites.
(mean ± SE) per fruit spur cluster (n = 20) in plots treated June 9th 1995. Values are for samples taken July 19th 1995.

	Parasite life stage		
	chalcids	braconids	percent parasitism
CYGON	1.2±.30a	0 ± 0	17.6±4.6a
CONFIRM full rate	.55±.14a	.05±.05a	12.6±3.7a
CONFIRM two 50% rate	.95±.29a	.20±.12a	36.5±12.2b

* Means within a column sharing a common letter are not significantly different (P = 0.05) according to Tukey's LSD test (SAS 1989).

Table 4a. Mean* seasonal abundance of spotted tentiform leafminers and associated parasites. (mean ± SE) per fruit spur cluster (n = 20) in plots treated June 9th 1995. Values are for samples taken July 31th 1995.

	Leafminer life stage		Parasite life stage			
	eggs	mines	sap feeder		tissue feeder	
			alive	dead	alive	dead
CYGON	5.8±1.3ab	26.5±4.1a	19.8±3.3a	3.0±.66a	2.1±.52a	.50±.17a
CONFIRM full rate	1.5±.36b	5.5±.70b	2.0±.45b	1.9±.35a	.50±.15b	.30±.16a
CONFIRM two 50% rate	9.0±3.0a	17.9±2.3c	10.2±1.3c	6.4±1.3b	.40±.17b	.20±.09a

* Means within a column sharing a common letter are not significantly different (P = 0.05) according to Tukey's LSD test (SAS 1989).

Table 4b (continued from 4a). Mean* seasonal abundance of spotted tentiform leafminers and associated parasites.
(mean ± SE) per fruit spur cluster (n = 20) in plots treated June 9th 1995. Values are for samples taken July 31th 1995.

	Parasite life stage		
	chalcids	braconids	percent parasitism
CYGON	1.2 ±.22a	.15±.11	7.2±2.3a
CONFIRM	.15±.08b	0 ±.0	2.5±1.4a
CONFIRM two 50% rate	.40±.15b	0 ± 0	3.1±1.2a

* Means within a column sharing a common letter are not significantly different (P = 0.05) according to Tukey's LSD test (SAS 1989).

Table 5a. Mean* seasonal abundance of spotted tentiform leafminers and associated parasites. (mean ± SE) per fruit spur cluster (n = 20) in plots treated June 9th 1995. Values are for samples taken August 14th 1995.

	Leafminer life stage		Parasite life stage			
	eggs	mines	sap feeder		tissue feeder	
			alive	dead	alive	dead
CYGON	2.9±.55a	36.3±3.4ab	23.5±2.2a	2.3±.48a	3.9±.68a	4.6±.97a
CONFIRM full rate	3.2±.69a	24.1±3.1b	13.1±.2.4b	5.2±.69a	2.1±.45b	2.9±.41ab
CONFIRM two 50% rate	3.4±1.2a	38.7±6.2a	19.6±3.7ab	13.4±2.8b	1.9±.57b	2.6±.49b

* Means within a column sharing a common letter are not significantly different (P = 0.05) according to Tukey's LSD test (SAS 1989).

Table 5b (continued from 5a). Mean* seasonal abundance of spotted tentiform leafminers and associated parasites.
(mean ± SE) per fruit spur cluster (n = 20) in plots treated June 9th 1995. Values are for samples taken August 14th 1995.

	Parasite life stage		
	chalcids	braconids	percent parasitism
CYGON	3.9±.63a	1.5±.41a	13.8±1.9a
CONFIRM full rate	1.9±.36b	.35±.18b	11.6±2.6a
CONFIRM two 50%	1.8±.37b	.45±.27b	5.5±1.3b

* Means within a column sharing a common letter are not significantly different (P = 0.05) according to Tukey's LSD test (SAS 1989).

Table 6a. Mean* seasonal abundance of spotted tentiform leafminers and associated parasites. (mean ± SE) per fruit spur cluster (n = 20) in plots treated June 9th 1995. Values are for samples taken August 29th 1995.

	Leafminer life stage				Parasite life stage	
	eggs	mines	sap feeder		tissue feeder	
			alive	dead	alive	dead
CYGON	3.3±.63a	48.0±4.9a	26.9±3.2a	10.6±1.6a	1.4±.30a	7.9±1.1a
CONFIRM full rate	1.4±.48b	19.9±2.9b	10.1±1.6b	7.9±1.5ab	.35±.13b	1.3±.34b
CONFIRM two 50% rate	2.7±.62ab	22.2±4.7b	13.5±2.4ab	5.8±1.9b	.15±.08b	2.6±.58b

* Means within a column sharing a common letter are not significantly different (P =0.05) according to Tukey's LSD test (SAS 1989).

Table 6b (continued from 6a). Mean* seasonal abundance of spotted tentiform leafminers and associated parasites.
(mean ± SE) per fruit spur cluster (n = 20) in plots treated June 9th 1995. Values are for samples taken August 29th 1995.

	Parasite life stage		
	chalcids	braconids	percent parasitism
CYGON	6.7±.66a	1.4±.36a	18.7±1.8a
CONFIRM full rate	1.5±.29b	.70±.19a	11.8±2.3b
CONFIRM two 50% rate	1.3±.32b	.80±.19a	11.5±2.5b

* Means within a column sharing a common letter are not significantly different (P = 0.05) according to Tukey's LSD test (SAS 1989).

#016 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Apple, cv. Cortland

PEST: Tentiform leafminer, *Phyllonorycter blancardella*
White apple leafhopper, *Typhlocyba pomaria*

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TITLE: ADMIRE FOR CONTROL OF INSECT PESTS IN APPLE, 1995

MATERIALS: ADMIRE FS (BAY-NTN-33893 240 g/L); THIODAN 360 EC (endosulfan 360 g/L)

METHODS: The experiment was conducted in a commercial orchard in St. George Ontario. The treatments were assigned to single tree plots, replicated 3 times and arranged according to a randomized complete block design. Applications to all treatments were made using a commercial orchard sprayer and handgun calibrated to deliver 2500 L/ha at a spray pressure of 2760 kPa. The application was made post-bloom on July 5, 1995. TLM egg hatch had occurred and their were sap and tissue-feeding mines present at the time of application. Leafhopper nymphs were present at the time of application. Efficacy and visual phytotoxicity ratings were conducted at -1, 3, 13, 24 and 36 d after treatment (DAT). Tentiform leafminer were assessed by counting 200 leaves/plot and recording the number of sap and tissue-feeding mines caused by the insect larvae. The number of white apple leafhopper nymphs present on 200 leaves was also recorded. Efficacy data were analysed using an analysis of variance and Duncan's Multiple Range Test at the 5% significance level.

RESULTS: There was no visual phytotoxicity caused by any of the treatments tested. Efficacy data has been presented in Tables 1, 2 and 3.

CONCLUSIONS: Both insecticide treatments significantly reduced the number of tentiform leafminer sap-feeding larvae found in treated plots compared to the untreated plots at 24 DAT. BAY-NTN-33893 treated trees had significantly fewer sap-feeding mines than trees treated with THIODAN at 24 and 36 DAT. The application missed the majority of first generation sap-feeding larvae, however, BAY-NTN-33893 provided good control of the second generation of TLM more than 30 d after treatment.

BAY-NTN-33893 provided good control of tissue-feeding TLM larvae at 36 DAT. Leafhopper numbers were not great enough to assess the effectiveness of these treatments for leafhopper control.

Table 1. Mean number of sap-feeding tentiform leafminer (TLM) on Cortland apple trees treated with insecticides, 1995.

Treatment	Form	Rate gai/ha	TLM sap feeders #/200 lvs -1 DAT	TLM sap feeders #/200 lvs 3 DAT	TLM sap feeders #/200 lvs 13 DAT	TLM sap feeders #/200 lvs 24 DAT	TLM sap feeders #/200 lvs 36 DAT
Untreated	----	----	4.7 a*	0.0 a	2.0 a	106.0 a	89.3 a
BAY-NTN-33893	240 FS	90	1.3 a	0.0 a	1.0 a	5.3 c	7.3 b
THIODAN	360 EC	1625	2.7 a	0.0 a	1.3 a	56.0 b	60.0 a

* Means followed by the same letter within a column are not significantly different (P = 0.05, Duncan's MRT).

Table 2. Mean number of tissue-feeding tentiform leafminer (TLM) on Cortland apple trees treated with insecticides, 1995.

Treatment	Form	Rate gai/ha	TLM tis feeders #/200 lvs -1 DAT	TLM tis feeders #/200 lvs 3 DAT	TLM tis feeders #/200 lvs 13 DAT	TLM tis feeders #/200 lvs 24 DAT	TLM tis feeders #/200 lvs 36 DAT
Untreated	----	----	36 a*	46 a	11 a	22 a	110 a
BAY-NTN-33893	240 FS	90	24 a	38 a	17 a	12 a	26 b
THIODAN	360 EC	1625	25 a	32 a	17 a	17 a	62 ab

* Means followed by the same letter within a column are not significantly different (P = 0.05, Duncan's MRT).

Table 3. Mean number of white apple leafhopper nymphs on Cortland apple trees treated with insecticides, 1995.

Treatment	Form	Rate gai/ha	nymphs #/200 lvs -1 DAT	nymphs #/200 lvs 3 DAT	nymphs #/200 lvs 13 DAT	nymphs #/200 lvs 24 DAT	nymphs #/200 lvs 36 DAT
Untreated	----	----	5.3 a*	0.0 a	0.7 a	0.0 a	4.0 a
BAY-NTN-33893	240 FS	90	4.0 ab	0.3 a	0.7 a	0.0 a	0.0 a
THIODAN	360 EC	1625	2.0 b	0.0 a	0.3 a	0.0 a	2.0 a

* Means followed by the same letter within a column are not significantly different (P = 0.05, Duncan's MRT).

#017 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Apple, cv. Idared

PEST: Tentiform leafminer, *Phyllonorycter blancardella*
White apple leafhopper, *Typhlocyba pomaria*

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TITLE: ADMIRE FOR CONTROL OF INSECT PESTS IN APPLE, 1995

MATERIALS: ADMIRE FS (BAY-NTN-33893 240 g/L); LANNATE L (methomyl 215 g/L)

METHODS: The experiment was conducted in a commercial orchard in St. George Ontario. The treatments were assigned to single tree plots, replicated 4 times and arranged according to a randomized complete block design. Applications to all treatments were made using a commercial orchard sprayer and handgun calibrated to deliver 2500 L/ha at a spray pressure of 2760 kPa. The application was made post-bloom on July 5, 1995. TLM egg hatch had occurred and their were sap and tissue-feeding mines present at the time of application. Efficacy and visual phytotoxicity ratings were conducted at -1, 3, 13, 24 and 36 d after treatment (DAT). Tentiform leafminer were assessed by counting 200 leaves/plot and recording the number of sap and tissue-feeding mines caused by the insect larvae. The number of white apple leafhopper nymphs present on 200 leaves was also recorded. Efficacy data were analysed using an analysis of variance and Duncan's Multiple Range Test at the 5% significance level.

RESULTS: There was no visual phytotoxicity caused by any of the treatments tested. Efficacy data has been presented in Tables 1, 2 and 3.

CONCLUSIONS: Both insecticide treatments significantly reduced the number of tentiform leafminer sap-feeding larvae found in treated plots compared to the untreated plots. This reduction in treated plots was evident by 13 DAT. There was no difference between chemical treatments at 13 or 24 DAT but by 36 DAT BAY-NTN-33893 treated trees had significantly fewer sap-feeding mines than trees treated with LANNATE L. The application missed the majority of first generation sap-feeding larvae, however, BAY-NTN-33893 provided good control of the second generation of TLM more than 30 d after treatment.

There was no control of tissue-feeding TLM larvae by either treatment. Leafhopper numbers were not great enough to assess the effectiveness of these treatments for leafhopper control.

COMMENTS: The effectiveness of BAY-NTN-33893 applied post-bloom for the control of sap-feeding tentiform leafminer larvae is important because there is only one other product recommended for the control of tentiform leafminer once their eggs have hatched. As was the case in some orchards this year, if the egg threshold is not reached prior to the bloom period and the egg hatch occurs during bloom a pyrethroid can not be used effectively. The registration of BAY-NTN-33893 would provide a choice of products to be used for this market. Its registration might also lead to reduced pyrethroid use in orchards which could benefit current IPM programs and help reduce the risk of pyrethroid resistance.

Table 1. Mean number of sap-feeding tentiform leafminer (TLM) on Idared apple trees treated with insecticides, 1995.

Treatment	Form	Rate	TLM sap feeders #/200 lvs -1 DAT	TLM sap feeders #/200 lvs 3 DAT	TLM sap feeders #/200 lvs 13 DAT	TLM sap feeders #/200 lvs 24 DAT	TLM sap feeders #/200 lvs 36 DAT
Untreated	-----	----	0.5 a*	1.3 a	10.0 a	149.0 a	111.5 a
BAY-NTN-33893	240 FS	90 g a.i./ha	1.5 a	1.8 a	3.0 b	38.0 b	24.5 c
LANNATE L	215 L	6.8 L prod/ha	0.0 a	0.3 a	2.3 b	55.5 b	72.0 b

* Means followed by the same letter within a column are not significantly different (P = 0.05, Duncan's MRT).

Table 2. Mean number of tissue-feeding tentiform leafminer (TLM) on Idared apple trees treated with insecticides, 1995.

Treatment	Form	Rate	TLM tis feeders #/200 lvs -1 DAT	TLM tis feeders #/200 lvs 3 DAT	TLM tis feeders #/200 lvs 13 DAT	TLM tis feeders #/200 lvs 24 DAT	TLM tis feeders #/200 lvs 36 DAT
Untreated	-----	----	43 a*	37 a	30 a	48 a	73 a
BAY-NTN-33893	240 FS	90 gai/ha	50 a	42 a	31 a	37 a	52 a
LANNATE L	215 L	6.75L prod/ha	47 a	27 a	29 a	35 a	83 a

* Means followed by the same letter within a column are not significantly different (P = 0.05, Duncan's MRT).

Table 3. Mean number of white apple leafhopper nymphs on Idared apple trees treated with insecticides, 1995.

Treatment	Form	Rate	nymphs #/200 lvs -1 DAT	nymphs #/200 lvs 3 DAT	nymphs #/200 lvs 13 DAT	nymphs #/200 lvs 24 DAT	nymphs #/200 lvs 36 DAT
Untreated	-----	----	0.0 a*	0.5 a	0.3 a	0.0 a	3.5 a
BAY-NTN-33893	240 FS	90 gai/ha	0.5 a	1.0 a	0.3 a	0.0 a	0.0 a
LANNATE L	215 L	6.75L prod/ha	1.5 a	0.0 a	0.0 a	0.0 a	0.0 a

* Means followed by the same letter within a column are not significantly different (P = 0.05, Duncan's MRT).

#018 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Apples, cv. Liberty/M9

PEST: Western flower thrips, *Frankliniella occidentalis* (Pergande)

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TITLE: INFLUENCE OF ORCHARD FLOOR VEGETATION ON SPRING WESTERN FLOWER THRIPS ESTABLISHMENT

MATERIALS: One replicate with three blocks of Liberty/M9 apples with guard rows of Empire/M9 was planted in 1993. A second replicate was planted in 1994. Each block consisted of six rows, 3.5 m apart x 24 m long with a spacing of 1.5 m between trees. The trees were trained as a modified slender spindle and were fertigated to provide 15 g P/tree in the early season and 30 g N/tree as NH_4NO_3 from late May to mid July. The orchard floor vegetation in the three blocks was: 1) maintained completely clean throughout the year with a combination of tillage, contact and residual herbicides; 2) a pure grass sod of perennial rye grass and creeping red fescue and maintained free of broadleaf weeds with 2,4-D and mecoprop; and 3) the same grass sod as in 2 rototilled lightly in the summer of 1994 and seeded with white clover and a wide assortment of local broadleaf weeds. Tree rows were maintained relatively weed free with regular herbicide applications. At pink-stage of bud development, three groups of six adjacent trees were tagged within each ground cover. At this time limbs from each tree were tapped to determine western flower thrips establishment and cover sweeps were carried out within each block. Limb taps and cover sweeps were repeated one, two, five and ten weeks later and western flower thrips assessed. At fruit set, five clusters were collected per monitored tree and the number of western flower thrips recorded. In June, all fruit was harvested from each monitored tree and thrips damage recorded. Total insect counts and damaged fruits were statistically compared using an ANOVA and the means compared using a Duncan's Multiple Range Test.

RESULTS: Limbtap counts indicated that western flower thrips counts were significantly ($P<0.05$) lower in trees with a soil (2.5 thrips/tap) or grass ground cover (2.4 thrips/tap) versus weed cover (3.5 thrips/tap). When examined over time, this lower flower thrips count in soil and grass versus weeds was significant ($P<0.05$) during bloom (week 1) when thrips counts in the trees were highest and when female thrips were causing the pansy spot apple damage (Table 1). Cover sweeps showed a significant ($P<0.05$) reduction in the number of western flower thirps in the soil (0 thrips/sweep) and grass cover (0.9 thrips/sweep) versus the weed cover (6.7 thrips/sweep) over the whole sample period as well as from pre-release, through bloom and into mid-July (Table 1). Cluster samples conducted sufficiently post-blossom , that the collected thrips represented the F_1 generation from the damaging blossom population, showed significantly ($P<0.05$) fewer western flower thrips from trees in the soil blocks (19.4 thrips/cluster) versus the grass blocks (29.2 thrips/cluster) versus the weed cover blocks (36.5 thrips/block). The percent of apples damaged by the western flower thrips was not significantly ($P>0.05$) less from trees in the soil (19.0%) or grass blocks (21.0%) than from trees in the weed cover blocks (24.0%).

CONCLUSION: From this data it may be concluded that the flowering weed ground cover encouraged thrips movement into the orchard, Although the soil and grass discourage western flower thrips establishment in the orchard, these ground covers are not sufficient to act as efficient independent control strategies.

Table 1. Mean western flower thrips/limb tap and cover sweep over time.

Week	Ground cover	Mean thrips/ limb tap	Mean thrips per cover sweep
0	soil	0.1 a*	0.0 b
(pink)	grass	0.0 a	0.0 b
	weed	0.1 a	8.9 a
1	soil	6.8 b	0.0 b
(blossom)	grass	5.9 b	0.3 b
	weed	9.6 a	15.0 a
2	soil	3.1 a	0.0 b
(petal fall)	grass	3.0 a	1.3 b
	weed	4.1 a	7.8 a
5	soil	1.0 a	0.0 b
	grass	0.6 a	1.3 b
	weed	1.1 a	13.8 a
10	soil	0.2 b	0.0 b
	grass	0.6 a	0.3 ab
	weed	0.5 a	0.6 a

* Means within the same sample technique and within the same week followed by the same letter are not significantly ($P<0.05$) different.

#019 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* cv. Northline, Thiessen, Smoky

PEST: Woolly elm aphid, *Eriosoma americanum* (Riley)

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TITLE: EIGHT INSECTICIDES TESTED FOR CONTROL OF WOOLLY ELM APHID ON ROOTS OF SASKATOON BERRY SEEDLINGS AT THREE SITES IN SASKATCHEWAN

MATERIALS: ADMIRE 24FL (imidacloprid); BAYGON 18EC (propoxur); CYGON 48EC (dimethoate); DURSBAN 48EC (chlorpyrifos); MALATHION 50EC (malathion); ORTHENE 75WP (acephate); SEVIN 48FL (carbaryl); VYDATE 25SL (oxamyl)

METHODS: The woolly elm aphid is a pest of roots of saskatoon berry. Eight insecticides were evaluated at three sites in 1995 (Marquis SK, Truax, SK, Saskatoon, SK). Treatments were applied by soil injection, drip irrigation or foliar spray. See Table 1 for a list of rates and application methods. Each site was a U-Pick orchard with rows spaced 3 m apart and an in-row spacing of 1 m. At Marquis, 6 reps were 3-year old Northline and 4 reps were 3-year old Thiessen. At Truax, 10 reps were 3-year old Thiessen. At Saskatoon, 6 reps were 2-year old Thiessen and 4 reps were 4-year old Smoky. Fifteen treatments were tested at each site in a randomized complete block design with single plant plots and 10 replications per site. Treatments were applied to non-fruit bearing plants after aphid migration from elm to saskatoon was completed and after general berry harvest.

Soil injection was accomplished by using a CO_2 pressurized backpack sprayer (R & D Sprayer Inc., Model D-201S) equipped with a modified handgun that had a shop built soil probe instead of a spray nozzle. The probe was constructed of a 10 mm diameter hollow metal pipe with a pointed end and a slit cut along one side of the pipe about 2 cm from the tip. At 200 kPa, about 2 L/min of fluid flowed through the slit in a 90 degree fan pattern. The probe was pushed into the soil to a depth of about 12 cm, with 3 - 5 probes made around each seedling at a distance of about 15 cm from the main stem. Two litres of solution was delivered to each seedling using the soil injector.

Drip treatments were applied using an apparatus that duplicated a drip irrigation system. The apparatus consisted of a 20 L pail placed on a 33 cm x 33 cm x 28 cm frame. An emitter in the bottom of the pail allowed the solution to flow at a rate of 10 L/ha through a spaghetti line to the base of a single plant. Ten litres of solution was applied to each plant. Dikes of soil were formed around each seedling to hold the solution and allow for soil saturation.

Foliar spray treatments were applied using a CO_2 pressurized backpack sprayer (R & D Sprayers Inc., Model D-201S) at 200 kPa with a 8002 nozzle. Approximately 100 to 150 ml of solution were applied to the leaves of each seedling.

Treatment dates were July 24, 25 and 27 at Marquis, Truax and Saskatoon, respectively. A visual estimate of phytotoxicity was made by examining each plant and estimating the percentage of leaves that exhibited yellowing or browning. Phytotoxicity ratings and root infestation measurements were taken on August 16, 23 and 22 for Marquis, Truax and Saskatoon, respectively. Root infestation measurements were taken by examining half the roots of each plant. A 15 cm deep trench was dug in a semicircle approximately 30 cm away from each plant. The soil around the roots was carefully removed to expose aphid colonies. Only roots within a 20 cm radius of the main shoots were assessed. The length of infested root was measured and later converted to an infestation class (0-4) as shown in Table 2. A square root (x + 0.5) transformation was conducted on the phytotoxicity and root infestation ratings prior to analysis of variance with means separated by the Student-Newman-Keul test.

RESULTS: CYGON applied by drip irrigation caused severe phytotoxic damage, with the next most damaging treatment being CYGON applied by soil injection (Table 1), MALATHION applied as a drip caused significant damage at one of the three test sites. All other treatments did not exhibit significant phytotoxicity.

ORTHENE Drip, CYGON Drip, CYGON Inject and ADMIRE Inject were the only treatments to virtually eliminate the root aphid at all three test sites (Table 3). Treatments that significantly reduced aphid populations at 2 of 3 sites were: ADMIRE Drip, MALATHION Drip, ORTHENE Inject and VYDATE Drip. Treatments that significantly reduced the aphid populations at 1 of 3 sites were: BAYGON Inject, MALATHION Inject and SEVIN Inject. Treatments that failed to reduce aphid populations at any test site were: ADMIRE Spray and DURSBAN Inject.

CONCLUSIONS: The treatments with the best control and least phytotoxic effects were ORTHENE Drip, ADMIRE Inject, ORTHENE Inject, ADMIRE Drip and VYDATE Drip. Although CYGON showed good control, phytotoxic damage was severe, especially for the Drip application. CYGON should not be used at the rates tested. MALATHION Drip should not be used because of phytotoxic damage. ADMIRE Spray, BAYGON Inject, DURSBAN Inject, MALATHION Inject and SEVIN inject should not be used because of poor or inconsistent control. Only systemic compounds reduced woolly elm aphid populations. Soil injection showed promise as an alternative to drip application for control of woolly elm aphid.

Table 1. Phytotoxicity evaluation of products used for control of woolly elm aphid on saskatoon roots at three locations in Saskatchewan in 1995.

Treatment	Rate (ml product/L)	Application method	Phytotoxicity (% leaves) Marquis	Truax	Saskatoon
ADMIRE 24FL	0.125	Spray	1.5 c*	0.5 c	0.0 b
ADMIRE 24FL	0.025	Drip	2.5 c	0.0 c	0.0 b
ADMIRE 24FL	0.063	Inject	0.0 c	0.0 c	0.0 b
BAYGON 18EC	1.0	Inject	0.5 c	0.0 c	0.5 b
CYGON 48EC	0.3	Drip	62.5a	100.0a	73.5a
CYGON 48EC	0.3	Inject	25.5 b	57.0 b	2.5 b
DURSBAN 48EC	0.375	Inject	2.5 c	0.0 c	0.5 b
MALATHION 50EC	2.0	Drip	14.5 bc	49.5 b	0.0 b
MALATHION 50EC	2.0	Inject	0.0 c	0.0 c	1.0 b
ORTHENE 75WP	0.85	Drip	0.0 c	0.0 c	0.0 b
ORTHENE 75WP	0.85	Inject	0.0 c	0.0 c	0.0 b
SEVIN 48FL	2.5	Inject	0.0 c	24.0 c	0.0 b
VYDATE 25SL	1.25	Drip	7.0 c	0.0 c	0.0 b
WATER CHECK	-	Drip	0.0 c	0.0 c	0.0 b
WATER CHECK	-	Inject	0.0 c	0.0 c	0.0 b

* Means in the same column followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test.

Table 2. Woolly elm aphid infestation ratings used for evaluation of products on saskatoon plants in 1995.

Aphid rating	Aphid infestation rating (cm of aphid infested roots)
0	0
1	1-3
2	4-7
3	8-14
4	15+

Table 3. Aphid infestation ratings for products used for control of woolly elm aphid on saskatoon roots at three locations in Saskatchewan in 1995.

Treatment	Rate (ml product/L)	Application method	Aphid infestation rating*,** Marquis	Truax	Saskatoon
ADMIRE 24FL	0.125	Spray	1.9a	3.4a	1.0ab
ADMIRE 24FL	0.025	Drip	0.3 b	0.0 c	1.0ab
ADMIRE 24FL	0.063	Inject	0.2 b	0.4 c	0.0 b
BAYGON 18EC	1.0	Inject	1.0ab	0.2 c	0.8ab
CYGON 48EC	0.3	Drip	0.0 b	0.0 c	0.0 b
CYGON 48EC	0.3	Inject	0.1 b	0.2 c	0.0 b
DURSBAN 48EC	0.375	Inject	1.6a	2.4ab	1.8ab
MALATHION 50EC	2.0	Drip	0.2 b	0.5 c	0.5ab
MALATHION 50EC	2.0	Inject	1.4a	1.8 b	1.8ab
ORTHENE 75WP	0.85	Drip	0.0 b	0.0 c	0.0 b
ORTHENE 75WP	0.85	Inject	0.0 b	0.6 c	0.5ab
SEVIN 48FL	2.5	Inject	1.5a	2.1 b	1.0ab
VYDATE 25SL	1.25	Drip	0.1 b	0.1 c	-
WATER CHECK	-	Drip	1.9a	3.2a	2.5a
WATER CHECK	-	Inject	1.9a	3.6a	2.5a

* Means in the same column followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test.

** In Saskatoon only last 4 reps used for aphid evaluation and Vydate treated plants not assessed for aphid infestation.

#020 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* cv. Martin, Nelson, Northline, Pembina, Smoky, Thiessen

PEST: Woolly elm aphid, *Eriosoma americanum* (Riley)

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TITLE: FIELD EVALUATION OF SIX CULTIVARS OF SASKATOON BERRY FOR SUSCEPTIBILITY TO WOOLLY ELM APHID

METHODS: The woolly elm aphid is a pest of roots of saskatoon plants. Tissue cultured plants of six saskatoon berry cultivars were field planted at Indian Head, Saskatchewan in May, 1994. The planting was arranged in a randonized complete block design with single plant plots and 30 replications. Plants were placed 1 m apart in the row and 4 m between rows. Soil was a heavy clay loam. Plants were irrigated by natural rainfall. Weed control was by tillage. No insecticides were applied to the plots in 1994 or 1995. Numerous mature American elm trees were within 1 km of the planting site.

Woolly elm aphid evaluations were conducted on three replications (reps 6, 20 and 28) on September 15, 1994 and 15 replications (reps 1 to 15) on August 16, 1995. Root infestation measurements were taken by examining half the roots of each plant. A 15 cm deep trench was dug in a semi-circle approximately 30 cm away from each plant. The soil around the roots was carefully removed to expose aphid colonies. The length of infested root was measured on excavated roots. All roots within a 30 cm radius of the main shoots were assessed. A square root (x + 0.5) transformation was conducted on root infestation ratings prior to analysis of variance with means separated by the Student-Newman-Keul test. Maximum plant height was measured August 16, 1995. The ratio of infested root to maximum plant height was calculated for each plant.

RESULTS: In 1994, no aphids were found on Martin, Nelson, Northline, Smoky or Thiessen and only one Pembina plant had aphids (6 cm infested root). Although this was a small sampling, it does suggest that aphid infestations on first year seedlings can be light and variable.

In 1995, there was a high infestation rate with 73.3 - 100 % of the plants infested for the six cultivars evaluated (Table 1). There was a significant difference in plant height with Smoky and Pembina being the tallest and Northline the shortest. There was no significant difference between cultivars in regards to the length of infested root nor was there a difference in the ratio of infested root to plant height. The planting will be evaluated in 1996 to determine the impact of root infestations on plant survival and performance.

CONCLUSIONS: Second year saskatoon berry seedling had a higher infestation rate than one year old seedlings. All cultivars evaluated were equally susceptible to infestation by the woolly elm aphid after two growing seasons.

Table 1. Plant height, length of woolly elm aphid infested root, ratio of infested root to plant height and percent of plants infested for six cultivars of 2-year old saskatoon berry at Indian Head, Saskatchewan

Cultivar	Plant height (cm)	Infested root (cm)	Ratio (infested root/ plant height)	Percent of plants infested
Martin	42.9 c	29.6a	0.647a	73.3
Nelson	46.0 c	31.2a	0.629a	92.9
Northline	24.6 d	22.3a	0.978a	92.3
Pembina	58.6ab	33.8a	0.587a	92.9
Smoky	61.3a	37.3a	0.591a	100.0
Thiessen	50.0 bc	29.4a	0.619a	93.3

* Means in the same column followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test.

#021 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* cv. Thiessen

PEST: Woolly elm aphid, *Eriosoma americanum* (Riley)

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TITLE: IMPACT OF GROUND COVERS ON INFESTATION BY WOOLLY ELM APHID ON SASKATOON BERRY AT TWO SITES IN SASKATCHEWAN

METHODS: The woolly elm aphid is a pest of roots of saskatoon plants. A trial was established at a clay loam site at Indian Head and a sandy loam site at White City, Saskatchewan in 1994 to determine the feasibility of ground covers for weed control and moisture conservation in newly established saskatoon plantations. As part of this trial, evaluations were made on the impact of these ground covers on infestation rates of the woolly elm aphid.

Ground covers tested included: embossed polypropylene, woven polypropylene, flax shivs and wood chips (Table 1). In addition there was a non-irrigated and irrigated check where weed control was conducted by hoeing and hand pulling. The embossed polypropylene was manufactured by Plasti-tech Culture Inc. of St. Remi, Quebec (101RB Embossed Polypropylene). The woven polypropylene was manufactured by DeWitt Products of Sikeston, Missouri (Sunbelt). The flax shivs were obtained from the Indian Head area where the Kimberly-Clark Corp. had extracted fibre from flax straw. Flax shivs are the woody portion of flax straw and are waste by-products of the fibre extraction process. Wood chips were obtained from a mechanical chipper that produced 1 to 3 cm chips from a mixture of deciduous trees. Elm was not used in the wood chip mixture. All ground covers had a 1 m width after installation. The flax shive and wood chip covers were approximately 10 cm deep. Water was applied to the irrigated plots when soil moisture tension approached 30 centibars. Rainfall was generally adequate in 1994 and 1995, therefore irrigation was seldom required in these irrigated plots. No irrigation was added to the ground cover plots.

Plots were arranged in a randomized complete block design with 6 plants/plot and 18 replications at Indian Head and 14 replications at White City. A tissue cultured source of the cultivar 'Thiessen' was used at both sites. Planting was done and ground covers installed in May of 1994. One plant in each plot was examined on August 29 to 31, 1995 for the presence of woolly elm aphid. Root infestation measurements were taken by examining half the roots of each plant. A 15 cm deep trench was dug in a semi-circle approximately 30 cm away from each plant. The soil around the roots was carefully removed to expose aphid colonies. The length of infested root was measured on excavated roots. All roots within a 30 cm radius of the main shoots were assessed. A square root (x + 0.5) transformation was conducted on root infestation ratings prior to analysis of variance with means separated by the Student-Newman-Keul test.

RESULTS: Ground cover had no significant affect on aphid infestation rates at White City, while at Indian Head, infestation rates were significantly higher under wood chips when compared to the controls. Infestation rates under wood chips and flax shivs at Indian Head were not significantly different. Infestation rates in the irrigated and non-irrigated control plots were similar at the same site and between sites.

CONCLUSIONS: Woolly elm aphid infestation was higher under wood chips (an organic ground cover) at Indian Head, but not at White City. The main difference between the sites appears to be soil type. We speculate that the aphid prefers or is more successful in sites with more moisture or more moderated temperatures. A heavier soil in combination with an organic ground cover would provide such conditions. The polypropylene ground covers were not associated with higher infestation rates at either site, therefore using these products as an alternative weed control method should not result in a greater aphid problem than using standard tillage methods.

Table 1. Effect of ground covers on infestation by woolly elm aphid on roots of 2-year old saskatoon berry plants at two sites in Saskatchewan.

	cm infested root*	
Treatment	Indian Head	White City
Embossed polypropylene	11.2 c	7.3a
Woven polypropylene	17.0 bc	12.7a
Flax shivs	26.5ab	11.3a
Wood chips	35.6a	9.2a
Irrigated control	16.1 bc	14.5a
Non-irrigated control	14.8 bc	15.0a

* Means in the same column followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test.

#022 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* cv. Smoky

PEST: Woolly elm aphid, *Eriosoma americanum* (Riley)

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TITLE: PHYTOTOXICITY OF CYGON APPLIED BY DRIP IRRIGATION OR SOIL INJECTION TO ROOTS OF SASKATOON BERRY SEEDLINGS FOR CONTROL OF WOOLLY ELM APHID AT TWO SITES IN SASKATCHEWAN

MATERIALS: CYGON 48EC

METHODS: The woolly elm aphid is a serious pest of roots of saskatoon berry. CYGON applied by drip irrigation or by soil injection was tested at three rates and two sites in 1995 (Lumsden, SK, Moosomin, SK,). Each site was a U-Pick orchard with rows spaced 3 m apart and an in-row spacing of 1 m. At Lumsden, all plants were 2-year old Smoky, while at Moosomin all plants were 4-year old Smoky. Eight treatments were tested at each site in a randomized block design with single plant plots and 10 replications per site. Treatments were applied to non-fruit bearing plants after aphid migration from elm to saskatoon was completed and after general berry harvest.

Soil injection was accomplished by using a CO_2 pressurized backpack sprayer (R & D Sprayer Inc., Model D-201S) equipped with a modified handgun that had a shop built soil probe instead of a spray nozzle. The probe was constructed of a 10 mm diameter hollow metal pipe with a pointed end and a slit cut along one side of the pipe about 2 cm from the tip. At 200 kPa, about 2 L/min of fluid flowed through the slit in a 90 degree fan pattern. The probe was pushed into the soil to a depth of about 12 cm, with 3 to 5 probes made around each seedling at a distance of about 15 cm from the main stem. Two litres of solution was delivered to each seedling using the soil injector.

Drip treatments were applied using an apparatus that duplicated a drip irrigation system. The apparatus consisted of a 20 L pail placed on a 33 cm x 33 cm x 28 cm frame. An emitter in the bottom of the pail allowed the solution to flow at a rate of 10 L/ha through a spaghetti line to the base of a single plant. Ten litres of solution was applied to each plant. Dikes of soil were formed around each seedling to hold the solution and allow for soil saturation.

Treatment dates were August 1 and 2 at Lumsden and Moosomin, respectively. A visual estimate of phytotoxicity was made by examining each plant and estimating the percentage of leaves that exhibited yellowing or browning. Phytotoxicity ratings and root infestation measurements were taken on August 25 and 28 for Lumsden and Moosomin, respectively. Root infestation measurements were taken by examining half the roots of each plant. A 15 cm deep trench was dug in a semicircle approximately 30 cm away from each plant. The soil around the roots was carefully removed to expose aphid colonies. Only roots within a 20 cm radius of the main shoots were assessed. The length of infested root was measured and later converted to an infestation class (0-4) as shown in Table 1. A square root (x + 0.5) transformation was conducted on the phytotoxicity and root infestation ratings prior to analysis of variance with means separated by the Student-Newman-Keul test.

RESULTS: Phytotoxic damage increased with increasing rates of CYGON (Table 2). More phytotoxic damage was noted when CYGON was applied by drip irrigation as compared to soil injection. Five times as much solution was applied to each plant when drip irrigation was used as compared to soil injection, which probably explains the additional phytotoxic damage in the drip treatments. Only the lowest rate of CYGON applied by soil injection did not significantly damage plants at both test sites.

Aphid populations at the Lumsden site were very low, thus no difference was detected between the CYGON treatments and the WATER CHECK. At the Moosomin site, all CYGON treatments had lower aphid populations compared to the WATER CHECK and there was no significant difference between CYGON treatments.

CONCLUSIONS: CYGON applied by soil injector at 0.1 ml product/L water and 2L solution/plant did not produce phytotoxic affects and did significantly reduce woolly elm aphid populations. Significant phytotoxic damage occurred when CYGON was applied at higher rates and/or with drip irrigation. All plants should be evaluated in the spring of 1996 to determine the impact of the phytotoxicity on plant survival.

Table 1. Woolly elm aphid infestation ratings used for evaluation of products on saskatoon plants in 1995.

Aphid rating	infestation rating (cm of aphid infested roots)
0	0
1	1-3
2	4-7
3	8-14
4	15+

Table 2. Phytotoxicity evaluation of Cygon used for control of woolly elm aphid on saskatoon roots at two locations in Saskatchewan in 1995.

Treatment	Rate (ml product/L)	Application method	Phytotoxicity (% leaves)		Aphid Infestation Rating	
			Lumsden	Moosomin	Lumsden	Moosomin
CYGON 48EC	0.1	Drip	46.0 b	23.5 c	0.1a	0.3 b
CYGON 48EC	0.1	Inject	1.0 e	0.0 d	0.4a	0.6 b
CYGON 48EC	0.2	Drip	56.5ab	56.5 b	0.0a	0.0 b
CYGON 48EC	0.2	Inject	10.0 d	1.0 d	0.1a	0.3 b
CYGON 48EC	0.3	Drip	68.5a	78.5a	0.0a	0.0 b
CYGON 48EC	0.3	Inject	29.5 c	15.0 c	0.0a	0.1 b
WATER CHECK	-	Drip	0.0 e	0.0 d	0.5a	2.9a
WATER CHECK	-	Inject	0.0 e	0.0 d	0.7a	2.8a

* Means in the same column followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test.

#023 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* cv. Thiessen

PEST: Woolly elm aphid, *Eriosoma americanum* (Riley)

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TITLE: PRODUCTS FOR PREVENTION OF ESTABLISHMENT OF WOOLLY ELM APHID ON ROOTS OF SASKATOON BERRY SEEDLINGS IN SASKATCHEWAN

MATERIALS: BRACO WOUND DRESSING; DORMANT OIL; DURSBAN 48 EC (chlorpyrifos); TANGLEFOOT; WINTERGREEN

METHODS: The woolly elm aphid is a pest of roots of saskatoon plants. The aphid overwinters as an egg on the bark of American elm. Fundatices produce pseudo galls on American elm leaves in the spring. Alate fundatrigenae migrate from the pseudogall to saskatoon plants from late June through late July. Nymphs are laid by the alatae on saskatoon leaves, then the nymphs walk from the leaves, down the stem to the roots of saskatoon. The aphid colonizes the root and from September through October the alatae return to American elm. A trial was established at Marquis, Saskatchewan to test various products that could act as a physical barrier, repellant or insecticide at the root collar so as to prevent the nymphs from moving from the leaves to the root. Treatments included, DORMANT OIL alone at two rates, DORMANT OIL with WINTERGREEN, DORMANT OIL with DURSBAN, DURSBAN alone, BRACO WOUND DRESSING, or TANGLEFOOT. Rates for each product are listed in Table 1. All treatments were applied to 3-year old Thiessen plants on June 20, 1995 which was at the start of woolly elm aphid migration to saskatoons. The eight treatments were arranged in a randomized complete block design with single plant plots and 10 replications. Treatments containing DORMANT OIL or DURSBAN were mixed with water and sprayed to the root collar to the point of run-off. A one litre hand pump sprayer was used to apply these solutions. TANGLEFOOT was applied by aerosol container while BRACO WOUND DRESSING was applied with a hand brush. For the TANGLEFOOT and BRACO treatments, a 4 cm band was applied to the stem at the soil line.

Treatments were assessed on August 16, 1995. Some plants were noted to be weakened such that the stems had softened and branches leaned and lay prostrate. A Stem Weakening Index was developed as follows: 0 = no stem leaning; 1 = 1 branch leaning; 2 = 2 or 3 branches leaning; 3 = 4 or 5 branches leaning; 4 = more than 5 branches leaning. Root infestation measurements were taken by examining half the roots of each plant. A 15 cm deep trench was dug in a semi-circle approximately 30 cm away from each plant. The soil around the roots was carefully removed to expose aphid colonies. Only roots within a 20 cm radius of the main shoots were assessed. The length of infested root was measured and later converted to an infestation class (0-11) as shown in Table 2. A square root (x + 0.5) transformation was conducted on root infestation ratings prior to analysis of variance with means separated by the Student-Newman-Keul test.

RESULTS: The high rate of DORMANT OIL and aerosol TANGLEFOOT caused a significant amount of stem weakening such that many branches were laying prostrate (Table 1). There was no significant difference in root aphid infestation ratings between any treatment and the CONTROL (Table 1).

CONCLUSIONS: The high rate of DORMANT OIL and aerosol TANGLEFOOT caused an unacceptable amount of plant damage in the form of stem weakening. None of the treatments tested prevented the woolly elm aphid from establishing on the roots of saskatoon plants. Either sufficient numbers of aphids had already established on the roots prior to treatment or nymphs were able to cross the treated area on the root collar and become established on the roots. None of these treatments can be recommended as a method to prevent root aphid damage.

Table 1. Stem weakening and root infestation ratings for products tested to prevent establishment of woolly elm aphid on roots of saskatoon plants at Marquis, Saskatchewan in 1995.

Treatment*	Stem ** weakening rating	Aphid ** infestation rating
BRACO WOUND DRESSING	0.7 b	7.6a
DORMANT OIL (50 ml)	0.7 b	6.6a
DORMANT OIL (200 ml)	2.1a	8.6a
DORMANT OIL (50 ml) + WINTERGREEN (5 ml)	0.4 b	6.8a
DORMANT OIL (50 ml) + DURSBAN 48 EC (10 ml)	0.3 b	7.7a
DURSBAN (10 ml)	0.5 b	7.5a
TANGLEFOOT	2.7a	4.5a
Control (water only)	0.6 b	6.6a

* Treatments containing DORMANT OIL or DURSBAN mixed in 1000L water.

** Means in the same column followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keul test.

Table 2. Ratings used for evaluation of products to prevent establishment of woolly elm aphid on roots of saskatoon plants in 1995.

Aphid rating	Aphid infestation rating (cm of aphid infested roots)
0	0
1	1-2
2	3-4
3	5-6
4	7-8
5	9-10
6	11-12
7	13-14
8	15-16
9	17-18
10	19-20
11	21+

ENTOMOLOGY / ENTOMOLGIE

VEGETABLE AND SPECIAL CROPS / LÉGUMES ET CULTURES SPÉCIALES

Section Editors / Réviseurs de section : J.G. Stewart, J.H. Tolman

#024 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61006538

CROP: Bean, dry edible, cv. Stinger, Envoy, Red Kidney, Gryphon, ExRico 23

PEST: Potato leafhopper, *Empoasca fabae* (Harris)

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TITLE: VALIDATION OF DAMAGE THRESHOLD FOR POTATO LEAFHOPPERS IN COMMERCIAL FIELDS OF DRY EDIBLE BEANS

MATERIALS: CYGON 480 E (dimethoate)

METHODS: The purpose of this study was to test, in commercial fields, a nominal decision threshold which was developed in small plots at Ridgetown over the last 6 years. In 1995, six commercial fields of edible beans, all greater than 4 ha, that growers decided to spray for leafhopper control were monitored for this pest and yield was measured. Growers decided to spray based on nymph counts done by a pest management scout. A minimum counting procedure involved sampling 10 leaflets of similar age from the centre area of the canopy replicated in 10 representative areas in the field. In larger fields we used a simple sequential sampling plan which is available upon request. A nominal decision threshold of 1 nymph/trifoliate and 2 nymphs/trifoliate was employed for early vegetative and early reproductive crop stages, respectively. Fields were sprayed with CYGON 480E at 1.0 L/ha in about 95-190 L/ha water with an overhead hydraulic field-sprayer. A non-treated strip (one sprayer-boom width or 18 m) at least 30 m long was left in each field. Ten pairs of yield samples were taken by hand from plots 2 rows x 2 m from each field during the last week of September when the beans were mature. One sample out of each pair was taken from the non-treated area with a neighbouring sample from the treated area at least 10 m from the edge of the non-treated area. The beans were planted in 0.76 m rows. The samples were threshed in a stationary thresher and yields were corrected to 18% moisture. Yields from each location were compared using a paired t-test.

RESULTS: All the fields, except one, were sprayed when the threshold was exceeded. There were good growing conditions following spraying with adequate rainfall (87 and 41 mm for June, July and August, compared with 16 year normals of 76, 86 and 76 mm for the same months). All the fields were sprayed when the crop was in the later vegetative or early reproductive stages.

There were only three fields that had significant differences in yield between treated and non-treated areas, two of which had a yield loss and only one with a yield advantage (Table 1).

CONCLUSIONS: Overall there was no advantage to spraying in all the fields which had exceeded the nominal threshold for potato leafhopper nymphs, with the exception of one field. The excellent growing conditions, allowed the crops to grow out of any deleterious effects of feeding by leafhoppers. These nominal thresholds have worked for us in previous years when the crops were growing under heat and drought stress. Therefore the thresholds should be tempered according to pending weather. The fact that two of the fields experienced a significant yield loss is concerning. There were no visible effects on crop growth after spraying with dimethoate. In the past we have noticed a yield loss after several application of CYGON in small plots, but have not documented a yield loss in a field situation with a single application. A closer look at the effects of spraying dimethoate on edibles beans with respect to crop development in the absence of leafhopper pressure is warranted.

Table 1. Validation of decision threshold for potato leafhoppers management in dry edible beans, Ontario. 1995.

		Date	Stage	Pre-spray Nymph	Yield (Tonnes/ha)		
Location	Cultivar	When	Sprayed	Counts*	Treat.	Non-treat.	Diff.
Denfield	Stinger	16 Jly	5-6 trif.	1.2	2.17	2.48	-0.32
Denfield	Envoy	16 Jly	5-6 trif.	0.2	1.93	2.02	-0.09
Denfield	Red Kidney	16 Jly	5-6 trif.	2.9	3.58	3.86	-0.29**
Zurich	Gryphon	24 Jly	8 trif.	4.5	1.91	1.85	+0.05
Zurich	Gryphon	24 Jly	12 trif.	2.4	1.33	1.56	-0.23**
Zurich	Ex Rico 23	20 Jly	early bloom	3.0	2.05	1.69	+0.36**

* Potato leafhopper nymphs/trifoliate.

** Significantly different by paired t-test (*P* <0.05).

#025 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61002030

CROP: Bean, white, cv. Ex Rico 23

PEST: Seed corn maggot, *Delia platura* (Meig.)

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TITLE: EFFECT OF LONG-TERM STORAGE OF TREATED SEED ON PERFORMANCE OF INSECTICIDE SEED TREATMENTS FOR THE CONTROL OF SEED CORN MAGGOT IN WHITE BEANS

MATERIALS: AGROX B-3 (diazinon 11% + lindane 16.6% + captan 33.5%);
AGROX D-L PLUS (diazinon 15% + lindane 25% + captan 15%);
DCT (diazinon 6% + captan 18% + thiophanate-methyl 14%);
VITAFLO 280 (carbathiin 14.9% + thiram 13.2%)

METHODS: The site was located at Ridgetown, Ontario, on a sandy loam soil, next to a storage pit for solid cattle manure. Solid cattle manure was disced in 4 weeks prior to planting to attract flies. Yellow sticky cards were placed in the field to monitor the adults. Plots were planted on 19 May, 1995, when there were about 2-5 adults/card/d. Plots were single 3 m rows spaced 0.76 m apart planted with 100 seeds/plot, using a John Deere Max-emerge planter, which was fitted with a cone seeder. Plots were arranged in a randomized complete block design with four replications. Seeds were treated in 2 kg lots and tumbled in a plastic bag for 30 s until uniformly covered. Seeds were treated either 2 d, 8 week or about 1 year prior to planting for a seed lot obtained from the 1993 crop and 2 d or 8 week before planting for a seed lot obtained from the 1994 crop. Slurries were prepared by adding 50 g of powder to 100 ml of water. Slurry rates were adjusted to reflect the rate of dry product. All of the seed was stored at room temperature (21•C) until planting. Percent emergence was calculated by counting all the plants emerged per plot at the first leaf stage (2 June) and relating that number to the total number of seeds planted. Percent injury was calculated the same day as the ratio of the number of seedlings showing maggot injury relative to the number of seedlings dug up in each plot. Non-emerged seeds/seedlings were included in this calculation.

RESULTS: The effect of long-term storage of seeds treated with seed treatments, to simulate carry over of treated seed from one year to the next, on the performance of insecticides for the control of seed corn maggot are presented in Table 1 (seedling emergence) and Table 2 (percent seedlings damaged). The effect of applying dust seed treatments in slurry form on the performance of insecticides for the control of seed corn maggot are presented in Table 3.

CONCLUSIONS: Generally insecticide seed treatments lost very little of their effectiveness in controlling seed corn maggot when treated seed was carried over from one year to the next (Table 1 and 2). The method of applying the seed treatments (dust or slurry) did not have an effect on the control of seed corn maggot (Table 3).

Table 1. Effect of long-term storage of treated white bean seed for seed corn maggot control on percent seed emergence. Ridgetown, Ontario, 1995.

	1993 seed			1994 seed	
	length of storage of treated seed			length of storage of treated seed	
Treatment	2 d	8 week	1 year	2 d	1 year
Control	30 b**	30 b	30 b	35 b	35 b
DCT*	58 a	70 a	71 a	70 a	70 a
DCT + B3	57 a	61 a	59 a	67 a	64 a
DCT + DL Plus	56 a	62 a	50 a	71 a	57 a
VIT. 280 + B3	68 a	57 a	53 a	71 a	66 a
VIT. 280 + DL Plus	63 a	54 a	57 a	73 a	65 a
B3	57 a	70 a	68 a	68 a	70 a
CV (%)	16.3	15.0	15.2	10.2	16.1

* VIT. = VITAFLO 280, DCT = DCT, B3 = AGROX B-3, DL Plus = AGROX D-L Plus, applied at 2.6, 5.2, 3.2 and 2.6 g or ml product/kg seed, respectively. DCT, B3 and DL Plus applied as slurry.

** Means followed by the same letter within columns do not significantly differ (P=0.05, Duncan's MRT). Data were transformed by ARCSIN (SQR) before ANOVA and mean separation. Reported means are detransformed.

Table 2. Effect of long-term storage of treated white bean seed for seed corn maggot control on percent seedlings damaged. Ridgetown, Ontario, 1995.

	1993 seed length of storage of treated seed			1994 seed length of storage of treated seed	
Treatment	2 d	8 week	1 year	2 d	1 year
Control	37 a**	37 a	37 a	70 a	70 a
DCT*	12 b	5 c	14 b	6 c	12 b
DCT + B3	33 ab	17 bc	11 b	20 b	21 b
DCT + DL Plus	20 ab	24 ab	17 ab	15 bc	26 b
VIT. 280 + B3	19 ab	13 bc	16 ab	17 bc	21 b
VIT. 280 + DL Plus	14 ab	10 bc	24 ab	8 bc	14 b
B3	15 ab	14 bc	11 b	9 bc	21 b
CV (%)	35.0	34.9	36.2	30.0	28.3

* VIT. = VITAFLO 280, DCT = DCT, B3 = AGROX B-3, DL Plus = AGROX D-L Plus, applied at 2.6, 5.2, 3.2 and 2.6 g or ml product/kg seed, respectively. DCT, B3 and DL Plus applied as slurry.

** Means followed by the same letter within columns do not significantly differ (P=0.05, Duncan's MRT). Data were transformed by ARCSIN (SQR) before ANOVA and mean separation. Reported means are detransformed.

Table 3. Effect of applying AGROX B-3 or AGROX D-L PLUS seed treatments as a slurry compared with dust on control of seed corn maggot in white beans. Ridgetown, Ontario, 1995.

Treatment	--% Emergence--		-% Damaged Plants--	
	Slurry	Dust	Slurry	Dust
Control*	35 b**	35 b	70 a	70 a
DCT Control	70 a	70 a	6 b	6 b
DCT + B3	67 a	66 a	20 b	15 b
DCT + DL Plus	71 a	73 a	15 b	13 b
VIT. Control	69 a	69 a	18 b	18 b
VIT. + B3	71 a	65 a	17 b	9 b
VIT. + DL Plus	73 a	68 a	8 b	10 b
B3	68 a	70 a	9 b	17 b
DL Plus	69 a	68 a	11 b	18 b
CV (%)	10.6	11.3	32.1	32.7

* VIT. = VITAFLO 280, DCT = DCT, B3 = AGROX B-3, DL Plus = AGROX D-L Plus, applied at 2.6, 5.2, 3.2 and 2.6 g or ml product/kg seed, respectively. DCT, B3 and DL Plus applied as slurry.

** Means followed by the same letter within columns do not significantly differ (P = 0.05, Duncan's MRT). Data were transformed by ARCSIN (SQR(%)) before ANOVA and mean separation. Reported means are detransformed.

#026 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61002030

CROP: Bean, white, cv. Ex Rico 23

PEST: Seed corn maggot, *Delia platura* (Meig.)

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TITLE: EFFECT OF LONG-TERM STORAGE OF SEEDS TREATED WITH INSECTICIDES FOR THE CONTROL OF SEED CORN MAGGOT ON SEED VIABILITY IN WHITE BEANS

MATERIALS: AGROX B-3 (diazinon 11% + lindane 16.6% + captan 33.5%);
AGROX D-L PLUS (diazinon 15% + lindane 25% + captan 15%);
DCT (diazinon 6% + captan 18% + thiophanate-methyl 14%)
VITAFLO 280 (carbathiin 14.9% + thiram 13.2%)

METHODS: Seeds were treated in 2 kg lots and tumbled in a plastic bag for 30 s until uniformly covered. Seeds were treated either 2 d, 8 week or about 1 year prior to planting for a seed lot obtained from the 1993 crop, and 2 d or 8 week before planting for a seed lot obtained from the 1994 crop. Slurries were prepared by adding 50 g of powder to 100 ml of water. Slurry rates were adjusted to reflect the rate of dry product. All of the seed was stored at room temperature (21•C) until planting. Each plot was a single row of 100 seeds planted in sterilized 25 x 50 cm plastic trays which were filled to a depth of 4 cm with pasteurized soil-less potting mix (ProMix BX). To conserve space there were 2 treatments per tray planted in four rows (25 seeds/row) spaced 5.5 cm apart planted across the width of each tray. Treatments were randomly assigned to trays with four replications in a randomized complete block design. After planting on 15 May, seeds were covered with 2 cm of potting mix, the soil was tamped and watered to field capacity. The trays were placed in a dark cooler at 10•C for 7 d until radicles were beginning to emerge. The trays were then moved to a greenhouse with temperatures set at 26•C D and 20•C N under natural light. Percent emergence was calculated by counting all the plants emerged per row when the most advanced plot had reached the first leaf stage (6 June). This number was then related to the total number of seeds planted. Plants were then cut at the soil line and fresh shoot weight was measured for each row.

RESULTS: Non-treated old and new seed had similar viability (Table 1). There was no loss in germination in new or old seed treated within 8 week of planting. Germination of seed treated with DCT alone was not affected by long-term storage. Adding AGROX B-3 as a dust or AGROX D-L PLUS as a slurry to DCT reduced germination in old seed stored for longer than 8 week. Storing old seed treated with VITAFLO 280 alone did not affect germination. Seedling vigour (fresh weight) was not affected by applications of DCT followed by storage up to one year for new or old seed, nor did adding AGROX B-3 or AGROX D-L PLUS to DCT. Reduced vigour occurred in old seed when VITAFLO 280 was applied alone and the seed was stored for 8 weeks or longer. Adding AGROX B-3 or AGROX D-L PLUS intensified the problem, even in new seed treated 8 week before planting. The effect of slurry or dust applications on seedling vigour was similar.

CONCLUSIONS: AGROX B-3 and AGROX D-L PLUS can safely be applied as a slurry. Seed treated with DCT can be carried over for one year, while seed treated with VITAFLO 280 cannot. DCT and AGROX B-3 can be applied as a slurry at the same time as DCT on new seed. AGROX B-3 or AGROX D-L PLUS should be applied closer to planting time when applied on top of VITAFLO 280. The risk of poor emergence of seed treated with DCT + AGROX B-3 or AGROX D-L PLUS carried over from the previous season is relatively low.

Table 1. Effect of long-term storage of treated seed and method of application of seed treatment on seed viability, Ridgetown, Ontario 1995.

	Seed	-Percent Emergence-		---Fresh Weight g/plot----	
	Treatment	Slurry	Dust	Slurry	Dust
1993 seed	Non-treated*	99 a**		131.8 ab	
Stored	DCT control	100 a		135.0 a	
1 year	DCT + B3	96 abc	94 bc	126.8 abc	117.0 a-d
	DCT + DL Plus	98 ab	97 ab	127.0 abc	123.5 a-d
	VIT control	98 ab		106.0 d	
	VIT + B3	97 abc	94 bc	122.5 a-d	115.0 bcd
	VIT + DL Plus	90 c	96 abc	110.8 cd	113.8 bcd
1993 seed	Non-treated	95 ab		140.3 ab	
Stored	DCT control	99 a		136.8 abc	
8 weeks	DCT + B3	99 a	97 ab	129.3 b-e	145.3 a
	DCT + DL Plus	94 b	97 ab	129.3 b-e	116.0 ef
	VIT control	95 ab		124.0 cde	
	VIT + B3	93 b	93 b	118.3 ef	109.5 f
	VIT + DL Plus	97 ab	95 ab	133.0 a-d	120.5 def
1993 seed	Non-treated	99 a		142.8 a	
Stored	DCT control	99 a		129.5 ab	
2 days	DCT + B3	98 a	96 a	130.0 ab	128.5 ab
	DCT + DL Plus	99 a	99 a	132.8 ab	117.5 b
	VIT control	100 a		128.5 ab	
	VIT + B3	99 a	97 a	124.3 ab	112.8 b
	VIT + DL Plus	100 a	95 a	114.3 b	112.8 b
1994 seed	Non-treated	97 a		139.3 a	
Stored	DCT control	97 a		132.3 ab	
8 weeks	DCT + B3	97 a	99 a	137.3 ab	130.3 ab
	DCT + DL Plus	95 a	97 a	123.0 ab	131.3 ab
	VIT control	99 a		132.8 ab	
	VIT + B3	97 a	96 a	124.3 ab	116.3 b
	VIT + DL Plus	95 a	98 a	115.3 b	120.0 ab
1994 seed	Non-treated	99 a		134.5 ab	
Stored	DCT control	99 a		140.8 a	
2 days	DCT + B3	95 a	99 a	116.8 b	125.3 ab
	DCT + DL Plus	98 a	99 a	136.0 ab	124.5 ab
	VIT control	100 a		139.3 ab	

VIT + B3	98 a	96 a	132.8 ab	125.5 ab
VIT + DL Plus	98 a	99 a	132.0 ab	134.8 ab

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* VIT = VITAFLO 280, DCT = DCT, B3 = AGROX B-3, DL plus = AGROX DL Plus, applied at 2.6, 5.2, 3.2 and 2.6 g or ml product/kg seed, respectively.

** Means followed by the same letter within clusters do not significantly differ (P = 0.05, Duncan's MRT). Data were transformed by ARCSIN (SQR(%)) before ANOVA and mean separation. Reported means are detransformed. CV's range from 5.8-7.6% and 7.0-10.7% for emergence and fresh weight, respectively.

#027 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61002030

CROP: Bean, white, cv. ExRico 23

PEST: Seed corn maggot, *Delia platura* (Meig.)

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TITLE: INSECTICIDE SEED TREATMENTS FOR THE CONTROL OF SEED CORN MAGGOT IN WHITE BEANS IN NATURALLY AND ARTIFICIALLY INFESTED PLOTS

MATERIALS: AGROX B-3 (diazinon 11% + lindane 16.6% + captan 33.5%);
AGROX D-L PLUS (diazinon 15% + lindane 25% + captan 15%);
DCT (diazinon 6% + captan 18% + thiophanate-methyl 14%);
PREMIERE (thiabendazole 1.6% + thiram 4.8% + lindane 40%);
UBI-2016-3 (carbathiin + thiram + lindane; 118 + 105 + 149 g ai/L);
UBI-2654 (lindane 300 g ai/L); UBI-2701 (bifenthrin 80 g ai/L);
VITAFLO 280 (carbathiin 14.9% + thiram 13.2%)

METHODS: The site was located next to a solid manure storage pit at Ridgetown, Ontario, on a sandy loam soil. Solid cattle manure was disced in 4 weeks prior to planting to attract flies. Plots were planted on 19 May, 1995 when adult SCMs were numerous (2 - 5/yellow sticky card). They were planted in 8 m rows spaced 0.76 m apart at 100 seeds/plot, using a John Deere Max-emerge planter, which was fitted with a cone seeder. The press wheels were lifted, resulting in open seed furrows. Plots were single rows, arranged in a randomized complete block design with four replications. Seeds were treated in 300 g lots and tumbled in a plastic bag for 30 s until uniformly covered. Plots were split into infested and non-infested subplots, each 1 m in length. In the week prior to planting, 24,000 SCM eggs, collected from an insecticide-susceptible laboratory culture, were mixed with 2.9 L of a 0.18% agar solution and stored at 5•C. Immediately after planting, 60 ml of the egg mixture were added by syringe to the seed in each open furrow (about 500 eggs/plot). The seed furrows were then closed by hand and tamped. Percent emergence was calculated by counting all the plants emerged per plot at the first leaf stage (1 June) and relating that number to the total number of seeds planted. Percent injury was calculated the same day as the ratio of the number of seedlings showing maggot injury relative to the number of seedlings dug up in each plot. Non-emerged seeds/seedlings were included in this calculation.

RESULTS: As presented in table. Emergence was slightly lower in artificially infested plots, but percent damage was not much higher in artificially infested plots. Artificial infestation at the application rates of eggs tested did not result in lower coefficients of variability. The treatment with the highest emergence and lowest seed corn maggot damage was DCT applied with AGROX D-L PLUS. None of the other materials tested improved control of SCM above that of DCT combined with AGROX D-L PLUS. VITAFLO 280 in combination with the higher rate of lindane controlled SCM similar to DCT but there may have been a reduction in emergence due to the higher rate of lindane.

CONCLUSIONS: The level of eggs applied in this test did not increase insect pressure nor did it improve the discrimination between treatments. Higher levels need to be tested. Adding some lindane to DCT improves SCM control. The combination of VITAFLO 280 and higher rates of lindane needed for SCM control may be harmful to seed germination. It is unclear whether this phenomenon is due to formulation or active ingredient.

Table 1. Control of seed corn maggot in naturally or artificially infested plots with seed treatments. Ridgetown, Ontario. 1995.

	Rate	------Natural----- Infestation		----Inoculated---- Infestation	
Seed Treatment	ml or g/ kg seed	Percent Emerged	Percent Damaged	Percent Emerged	Percent Damaged
1 DCT(SL)	5.2	84 ab*	13 abc	73 a	12 abc
2 DCT(SL) + B3 (SL)	5.2 + 3.2	94 a	5 bc	57 ab	16 abc
3 DCT(SL) + DL Plus (SL)	5.2 + 2.6	68 bc	7 abc	51 ab	9 bc
4 DCT(SL) + UBI-2654	5.2 + 2.2	75 abc	5 bc	47 ab	8 bc
5 UBI-2016-3	3.3	69 bc	17 a	54 ab	19 ab
6 UBI-2654 + VITA. 280	2.2 + 2.6	77 abc	15 ab	64 ab	15 abc
7 UBI-2654 + VITA. 280	3.3 + 2.6	57 bc	10 abc	49 ab	10 bc
8 UBI-2701 + VITA. 280	1.9 + 2.6	77 abc	17 a	73 a	18 abc
9 UBI-2701 + VITA. 280	3.8 + 2.6	56 bc	13 abc	69 a	10 abc
10 UBI-2654 + UBI-2701 + VITA. 280	2.2 + 1.9 + 2.6	54 c	10 abc	48 ab	17 abc
11 DL PLUS (dry)	2.6 + 2.6	51 c	4 c	51 ab	6 c
12 DCT (SL) + PREM.	5.2 + 1.0	62 bc	4 c	70 a	11 abc
13 VITA. 280 (Check)	2.6	69 bc	19 a	36 b	24 a
CV (%)(transformed data)		19.7	35.3	22.9	31.5

* Means followed by same letter do not significantly differ (P = .05, Duncan's Multiple Range Test). Data were transformed by ARCSIN(SQR(n)) before ANOVA and mean separation. Reported means are untransformed. SL = slurry application, dry = dust application, VITA. 280 = VITAFLO 280, B3 = AGROX B-3, DL Plus = AGROX D-L Plus, PREM. = PREMIERE ST.

#028 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100104

CROP: Cabbage, cv. Multi Keeper
Broccoli, cv. Cruiser

PEST: Imported cabbageworm, *Artogeia rapae* (L.)
Diamondback moth, *Plutella xylostella* (L.)

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TITLE: CONTROL OF INSECT PESTS ON CABBAGE AND BROCCOLI, 1995

MATERIALS: AC 303,630; AGRAL; RIPCORD (cypermethrin);
XKa 017 (*Bacillus thuringiensis* var. *kurstaki*);
THURICIDE HPC (*Bacillus thuringiensis* var. *kurstaki*)

METHODS: At the Cambridge Research Station, cabbage seedlings were transplanted June 15, in four-row plots, that were 15 m long. Rows were spaced 0.9 m apart and plots were separated by 3 m fallow spray lanes. Treatments were arranged in a randomized complete block design with four replications. A pre-treatment count on July 20 indicated a buildup in the population of insect pests. Insecticides were applied on July 26 with a tractor-mounted, four-row boom sprayer that delivered 800 L/ha at 450 kPa. Treatments were evaluated on July 31 by removing 5 plants from the centre two rows and examining them for larvae.

RESULTS: As presented in table.

CONCLUSIONS: Imported cabbageworm larvae were controlled by all treatments on both crops. Combinations of AC 303,630 and RIPCORD, and the highest rate of XKa 017 also controlled larvae of the diamondback moth on both crops. However, RIPCORD, the two low rates of XKa 017, and THURICIDE did not control diamondback moth on broccoli.

Table 1. Number of imported cabbageworms (IMP) and diamondback moth (DBM) larvae per plant on cabbage and broccoli, five days after treatment, 1995.

		Cabbage*		Broccoli*	
Treatment	g ai/ha	IMP	DBM	IMP	DBM
AC 303,630**	50	0.9b	0.1b	0.4b	0.1ab
AC 303,630** + RIPCORD	50 17	0.4b	0.0b	0.1b	0.0b
AC 303,630** + RIPCORD	50 35	0.2b	0.2b	0.3b	0.0b
RIPCORD**	35	0.6b	0.2b	0.4b	0.1ab
B.t. kurstaki (XKa 017)	0.75 L/ha	0.4b	0.1b	0.2b	0.1ab
B.t. kurstaki (XKa 017)	1.5 L/ha	0.5b	0.1b	0.1b	0.1ab
B.t. kurstaki (XKa 017)	2.5 L/ha	0.2b	0.0b	0.2b	0.0b
THURICIDE HPC	1.25 L/ha	0.5b	0.1b	0.6b	0.4a
Unsprayed check	-----	4.4a	0.9a	5.8a	0.4a
ANOVA (P• 0.05)		----	----	----	-----

* Means in each column followed by the same letter are not significantly different at P• 0.05 (Tukey's Studentized Range Test).

** Surfactant AGRAL added.

#029 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1452-8703

CROP: Cabbage, cv. Minicole

PEST: Imported cabbageworm, *Artogeia rapae (L.)*
Diamondback moth, *Plutella xylostella (L.)*

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TITLE: MANAGEMENT OF LEAF-FEEDING PESTS OF CABBAGE, 1995

MATERIALS: AC 303,630; CONFIRM (RH-5992); RIPCORD (cypermethrin)

METHODS: Cabbage seedlings were transplanted 0.5 m apart at a between-row spacing of 0.9 m on June 6. Plots, measuring 3.6 m wide and 23.0 m long, were arranged in a randomized complete block design with four replications. The number of leaf-feeding larvae were counted on six plants that were destructively sampled each week from head formation (July 14) until harvest (August 24). Insecticides were applied on July 17 and again when a threshold of 0.25 Cabbage Looper Equivalents (CLE) per plant was reached or exceeded. The numbers of ICW and DBM larvae were multiplied by 0.67 and 0.2, respectively, to convert them to the appropriate CLE value. Insecticides were applied with a tractor-mounted CO_2-pressurized sprayer that delivered 320 L of spray volume/ha at 240 kPa. The sticker COMPANION was used for all treatments at a rate of 10 ml sticker/10 L of water. After the initial treatment, insecticides were applied on the following dates: Treatments 2 and 3 on July 25, Treatment 4 on August 21, Treatment 5 on August 11, and Treatment 6 on July 25, August 11 and 21. Weeds were managed with a pre-plant application of trifluralin at 600 g a.i./ha and with several mechanical cultivations. Marketability and head weights were recorded for ten heads harvested on August 24 from the centre two rows of each plot. Heads were considered marketable if they were free of any insects, feeding damage, and frass. Analyses of variance (ANOVA) were performed on the data and the Least Squares Difference (LSD) was calculated if the ANOVA was significant at $P<0.05$. The proportion of marketable heads (PM) was transformed to the sqrt(arcsine(PM)) before analysis. Detransformed means are presented.

RESULTS: Relative to other years, the population of ICW was sparse in 1995. All products tested reduced the mean number of ICW on August 10 (Table 1). RIPCORD, AC 303,630 + the higher rate of RIPCORD, and CONFIRM provided season-long control of ICW larvae. Diamondback moth larvae dominated the complex of leaf-feeding pests in 1995. By August 3, all products significantly reduced the number of DBM larvae attacking plants (Table 2). Season-long control was achieved by AC 303,630, RIPCORD, and AC 303,630 + both rates of RIPCORD. With respect to CLE, all products tested protected cabbage plants from August 3 until harvest (Table 3). Yield of marketable heads this year was lower than in previous years (data not shown). Significantly more marketable heads were harvested from plots treated with insecticides than from the Check.

Conclusions: After August 3, RIPCORD and AC 303,630 + the higher rate of RIPCORD tended to be the most efficacious against leaf-feeding pests of cabbage in 1995.

Table 1. Impact of different insecticides on imported cabbageworm larvae (ICW), Harrington, P.E.I., 1995.*

Trmt		Rate	Mean No. ICW Larvae/6 Plants			
			July	---- August -----		
No.	Product	(g a.i. ha)	20	10	17	23
1	Check		0.0	0.8a	2.3a	2.6a
2	AC 303,63 0	50	0.3	0.0b	0.6b	2.1a
3	RIPCORD	35	0.0	0.0b	0.5b	0.3b
4	AC 303,630 + RIPCORD	50+17	0.3	0.6b	1.7b	2.4a
5	AC 303,630 + RIPCORD	50+35	0.0	0.0b	0.0b	0.3b
6	CONFIRM	144	0.0	0.0b	0.0b	0.0b
ANOVA P<0.05			ns	---	---	---

* Numbers are the means of four replications. Numbers within a column followed by the same letter are not statistically different (Duncans Multiple Range Test, P<0.05).

Table 2. Impact of different insecticides on diamondback moth (DBM)larvae, Harrington, P.E.I, 1995.*

Trmt		Rate	Mean No. ICW Larvae/6 Plants				
			---- July ----		------ August -------		
No.	Product	(g a.i./ha)	14	20	3	10	17
1	Check		18.2	17.7a	28.1a	44.6a	38.4a
2	AC 303,630	50	19.1	12.2a	1.1b	3.2b	5.0b
3	RIPCORD	35	16.5	7.5b	0.6b	1.7b	0.8b
4	AC 303,630 + RIPCORD	50+17	18.0	5.9b	0.8b	2.9b	9.8b
5	AC 303,630 + RIPCORD	50+35	17.7	5.4b	0.3b	10.5b	1.8b
6	CONFIRM	144	12.6	13.2ab	3.9b	13.8b	10.2b
ANOVA P<0.05			ns ---	---	---	---	---

* Numbers are the means of four replications. Numbers within a column followed by the same letter are not statistically different (Duncans Multiple Range Test, P<0.05).

Table 3. Impact of different insecticides on Cabbage Looper Equivalents (CLE) Harrington, P.E.I., 1995.*

Trmt No.	Product	Rate (g a.i. ha)	Mean No. ICW Larvae/6 Plants July 20	August 3	10	17	23
1	Check		3.5a	5.7a	9.4a	9.2a	4.7a
2	AC 303,630	50	3.6a	0.2b	6.3b	1.2bc	2.1b
3	RIPCORD	35	1.5b	0.1b	3.3b	0.5bc	0.5b
4	AC 303,630 + RIPCORD	50+17	1.4b	0.2b	1.0b	3.1b	1.7b
5	AC 303,630 + RIPCORD	50+35	1.1b	0.3b	2.1b	0.3c	0.3b
6	CONFIRM	144	2.6ab	0.8b	2.8b	2.1bc	1.8b
ANOVA P<0.05			---	---	---	---	---

* Numbers are the means of four replications. Numbers within a column followed by the same letter are not statistically different (Duncans Multiple Range Test, P<0.05).

#030 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100104

CROP: Canola, cv. Hyola

PEST: Crucifer flea beetle, *Phyllotreta crucifera* (Goeze)
Striped flea beetle, *Phyllotreta striolata* (Fabr.)

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TITLE: CONTROL OF FLEA BEETLE IN CANOLA BY IMIDACLOPRID AND LINDANE SEED TREATMENTS AND GRANULAR INSECTICIDES, 1995

MATERIALS: See Table 1.

METHODS: Seed for this trial was treated by Uniroyal Chemical and the appropriate amount of treated seed for each plot was weighed and placed in individual packets. COUNTER 5G was weighed and added to the appropriate packets of seed. The seeding rate was 5 kg/ha. At the Elora Research Station, plots of canola were seeded May 5, using a 6-row, tractor-mounted cone seeder that evenly delivered the treated seed to rows spaced 22.0 cm apart. Plots were trimmed to 5 m after seedlings emerged. The plant stand was estimated by counting two rows of canola seedlings per plot 4 d and 14 d after initial emergence. Shot-hole damage estimates were taken 3, 8, 11, 14 and 22 d after emergence, by evaluating the average damage per three plants at ten separate sites in the second and fifth rows of each plot. Each damage rating was done on the most recently emerged foliage of the plant; damage on earlier tissue was ignored. In this way, the current efficacy of the treatment was evaluated. Analysis of variance was performed on the mean of the ten observations per plot. Yield was taken by harvesting the six rows of each plot with a combine. Seed was dried and cleaned to remove chaff, stalks and damaged seed. The sample weight was converted to kg/ha before analysis.

RESULTS: Damage data are shown in Table 2. Stand and yield data are presented in Table 3.

CONCLUSIONS: All treatments, except the low rate of imidacloprid and terbufos, gave a full two weeks control of the flea beetle (Table 2). The combinations of imidacloprid and lindane were consistently as good or better than either of these products alone. The lower rates of product mixtures were as effective as the higher rates (Table 2).

None of the damage was severe enough to cause a significant reduction in stand or yield.

Table 1. Materials used for control of flea beetle on canola, 1995.

Treatments	Seed g ai/100 kg	Material
Untreated	-	
UBI-2627	200	imidacloprid
UBI-2627	400	imidacloprid
UBI-2696	250	lindane
UBI-2696	500	lindane
UBI-2696	750	lindane
UBI-2696	1,500	lindane
UBI-2627 + UBI-2696	200 + 250	imidacloprid + lindane
UBI-2627 + UBI-2696	200 + 500	imidacloprid + lindane
UBI-2627 + UBI-2696	200 + 750	imidacloprid + lindane
UBI-2627 + UBI-2696	400 + 250	imidacloprid + lindane
UBI-2627 + UBI-2696	400 + 500	imidacloprid + lindane
UBI-2627 + UBI-2696	400 + 750	imidacloprid + lindane
COUNTER 5G	7,500	terbufos

Table 2. Mean* damage index** on canola foliage at various times after initial emergence of seedlings.

	Days after initial emergence				
Treatments	3	8	11	14	22
Untreated	0.64a	1.18a	1.23a	1.55a	0.98ab
UBI-2627	0.38b	0.88ab	0.58bc	0.96bc	0.83ab
UBI-2627	0.35b	0.61bc	0.45bc	0.89bcd	0.81ab
UBI-2696	0.35b	0.54bc	0.58bc	0.80bcde	0.70ab
UBI-2696	0.29b	0.35c	0.30c	0.43e	1.16a
UBI-2696	0.33b	0.30c	0.44bc	1.01b	0.94ab
UBI-2696	0.25b	0.36c	0.34bc	0.35e	0.94ab
UBI-2627 + UBI-2696	0.39b	0.53bc	0.36bc	0.74bcde	0.66ab
UBI-2627 + UBI-2696	0.25b	0.40c	0.24c	0.66bcde	0.59b
UBI-2627 + UBI-2696	0.25b	0.41c	0.29c	0.44de	0.98ab
UBI-2627 + UBI-2696	0.34b	0.39c	0.33bc	0.36e	0.96ab
UBI-2627 + UBI-2696	0.29b	0.48bc	0.28c	0.56bcde	0.73ab
UBI-2627 + UBI-2696	0.20b	0.36c	0.40bc	0.55cde	1.04ab
COUNTER 5G	0.41ab	0.63bc	0.69b	0.61bcde	1.15a
ANOVA (P• 0.05)	----	----	----	----	----

* Means in each column followed by the same letter are not significantly different at P• 0.05 (Tukey's Studentized Range Test).

** Damage to the two innermost leaves was recorded as 0 = no damage, 0.5 = 12.5%, 1.0 = 25%, 2.0 = 50%, 3.0 = 75%, 4.0 = 100% of the leaf area consumed.

Table 3. Mean* number of plants per row, 4 and 14 days after seedling emergence and yield in canola, 1995.

Treatments	Stand/row 4 day	 14 day	Yield kg/ha
Untreated	85.0	89.5	1754.0
UBI-2627	73.8	81.8	2374.7
UBI-2627	97.8	76.1	2091.0
UBI-2696	79.3	86.3	2085.0
UBI-2696	74.0	76.5	2133.3
UBI-2696	64.0	75.4	2130.4
UBI-2696	78.8	85.6	2097.3
UBI-2627 + UBI-2696	73.4	82.4	1892.2
UBI-2627 + UBI-2696	68.0	75.0	2441.0
UBI-2627 + UBI-2696	70.4	85.5	2080.7
UBI-2627 + UBI-2696	70.4	68.9	2171.5
UBI-2627 + UBI-2696	60.4	70.9	2071.0
UBI-2627 + UBI-2696	70.1	82.1	2218.6
COUNTER 5G	65.5	74.3	2121.9
ANOVA (P• 0.05)	ns	ns	ns

* Means in each column followed by the same letter are not significantly different at P• 0.05 (Tukey's Studentized Range Test).

#031 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100104

CROP: Canola, cv. Hyola

PEST: Crucifer flea beetle, *Phyllotreta crucifera* (Goeze)
Striped flea beetle, *Phyllotreta striolata* (Fabr.)

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TITLE: CONTROL OF FLEA BEETLES IN CANOLA BY FIPRONIL AND LINDANE SEED TREATMENTS AND GRANULAR INSECTICIDES, 1995

MATERIALS: See Table 1.

METHODS: Seed for this trial was treated by Rhone Poulenc Chemical and the appropriate amount of treated seed for each plot was weighed and placed in individual packets. COUNTER 5G was weighed and added to the appropriate packets of seed. The seeding rate was 5 kg/ha. At the Elora Research Station, plots of canola were seeded May 5, using a 6-row, tractor-mounted cone seeder that evenly delivered the treated seed to rows spaced 22.0 cm apart. Rows were trimmed to 5 m after seedlings emerged. The plant stand was estimated by counting two rows of canola seedlings per plot, 4 and 14 d after initial emergence. Shot-hole damage estimates were taken 3, 8, 11, 14 and 22 d after emergence, by evaluating the average damage per plants at ten separate sites in the second and fifth rows of each plot. Each damage rating was done on the most recently emerged foliage of the plant; damage on earlier tissue was ignored. In this way, the current efficacy of the treatment was evaluated. Analysis of variance was performed on the mean of the ten observations per plot. Yield was taken by harvesting six rows of each plot with a combine. Seed was dried and cleaned to remove chaff, stalks and damaged seed. The sample weight was converted to kg/ha before analysis.

RESULTS: Damage data are shown in Table 1. Stand and yield data are presented in Table 2.

CONCLUSIONS: Lindane, and lindane + COUNTER controlled the flea beetle for a full two weeks following seedling emergence, indicating that lindane may have provided the activity against the flea beetle (Table 1). Fipronil seed treatments gave mixed results over the same two-week period, the lower rates actually out-performed the high rate, though generally they provided control but not as consistently as lindane and COUNTER. The high rate of thiodicarb provided control of the flea beetle on 3 of the 4 measurement dates during the two-week period following plant emergence.

None of the damage was severe enough to cause any significant loss in either stand density or yield (Table 2).

Table 1. Mean* damage index** caused by flea beetle adults on canola foliage at various times after seedling emergence.*

Treatments	g ai/kg seed	Days after initial emergence 3	8	11	14	22
Untreated check	----	0.55a	0.50a	0.55a	1.01a	0.96
EXP-80534A (lindane)	20	0.18b	0.14bc	0.18b	0.40b	0.91
EXP-80534A + COUNTER 5G (lindane + terbufos)	20 22	0.19b	0.10c	0.19b	0.30b	0.85
EXP-80415A (fipronil)	5	0.25b	0.34abc	0.25b	0.45b	0.96
EXP-80415A (fipronil)	10	0.23b	0.26abc	0.23b	0.48b	0.71
EXP-80415A (fipronil)	15	0.29ab	0.26abc	0.29ab	0.58b	0.73
EXP-8005A (thiodicarb)	5	0.39ab	0.38abc	0.39ab	0.65b	1.01
EXP-8005A (thiodicarb)	10	0.38ab	0.29abc	0.38ab	0.35b	0.64
EXP-8005A (thiodicarb)	15	0.26b	0.36abc	0.26b	0.49b	0.78
ANOVA (P• 0.05)		----	----	----	----	----

* Means in each column followed by the same letter are not significantly different at P• 0.05 (Tukey's Studentized Range Test).

** Damage to the two innermost leaves was recorded as 0 = no damage, 0.5 = 12.5%, 1.0 = 25%, 2.0 = 50%, 3.0 = 75%, 4.0 = 100% of the leaf area consumed.

All seed treatments contained the fungicide iprodione and thiram at 3.0 and 2.0 g ai/kg seed, respectively.

Table 2. Mean* number of plants per row, 4 and 14 days after seedling emergence and yield in canola, 1995.

	g ai/kg	Stand/5 m row		Yield
Treatments	seed	4 days	14 days	kg/ha
Untreated check	----	82.0	87.6	1288.8
EXP-80534A (lindane)	20	89.3	118.0	1399.0
EXP-80534A + COUNTER 5G (lindane + terbufos)	20 22	80.5	113.6	1078.0
EXP-80415A (fipronil)	5	84.6	117.8	1272.9
EXP-80415A (fipronil)	10	80.9	116.5	1219.9
EXP-80415A (fipronil)	15	76.8	103.3	1231.4
EXP-8005A (thiodicarb)	5	71.0	104.6	1264.7
EXP-8005A (thiodicarb)	10	80.9	101.3	1128.7
EXP-8005A (thiodicarb)	15	85.4	94.3	1382.3
ANOVA (P• 0.05)		----	-----	------

* Means in each column followed by the same letter are not significantly different at P• 0.05 (Tukey's Studentized Range Test).

All seed treatments contained the fungicide iprodione and thiram at 3.0 and 2.0 g ai/kg seed, respectively.

#032 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 364-1421-8704

CROP: Canola, var. Excel

PEST: Crucifer flea beetle, *Phyllotreta cruciferae* (Goeze)

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TITLE: CANOLA SEEDLING PROTECTION FROM FLEA BEETLE DAMAGE WITH GRANULAR AND SEED DRESSING INSECTICIDES

MATERIALS: FURADAN 10G (carbofuran); COUNTER 5G ST (terbufos);
ROVRAL ST (lindane 50% + iprodione 16.7%); ROVRAL (iprodione);
VITAVAX RS (lindane 68% + carbathiin 4.5% + thiram 9%);
VITAVAX (carbathiin 4.5% + thiram 9%); EXP-80415A (fipronil);
UBI-2608-3 (imidacloprid 40% + carbathiin + thiram)

METHODS: All canola treatments were seeded 19 May 1995, except treatments 6 and 7 which were seeded 25 May 1995. Plots were seeded at a rate of 5.6 kg/ha to a depth of 2 to 3 cm in 17.5 cm row spacings with a double disc press drill in a field at Glenlea, Manitoba. The plots were 1.25 m x 8.0 m and were replicated 5 times in a randomized complete block design. Two plant counts of 0.25 m^2/plot and a visual assessment of flea beetle damage throughout the plot were taken on June 8. Flea beetle damage was rated using a scale based on percent leaf surface area damaged; 0 = no damage; 0.5 = 5%; 1.0 = 10%; 2 = 25%; 3 = 50%; 3.5 = 75%; 4 = 100%. Yields were taken in September by straight combining the entire plot and drying the seed samples for a minimum of 72 h at 35°C before weighing.

RESULTS: Rates of the active ingredient in the table below refer only to the insecticidal components of the formulation or treatment.

CONCLUSIONS: Flea beetle populations were low in all treatments. The treatments with granular insecticides or lindane and COUNTER seed dressings had no visible feeding injury by flea beetles. The highest rate of EXP-80415A was the most effective at preventing flea beetle damage. UBI-2608-3 did not prevent feeding injury at any of the rates tested. COUNTER ST treatments provided the highest increase in yields, but this could not be attributed to differences in flea beetle control among treatments. Plants in the COUNTER ST treatments were less severely drought stressed because of their late seeding than those in other treatments, and were better able to respond to moisture that fell late in the season. All other treatments had yields that were not significantly different from the CHECK plots.

Table 1.

Treatments	Rate (g ai/ kg seed)	Plant Damage	Plants /m^2	Canola Yield (g/m^2)
1. CHECK	-	0.4	181ab*	165.2bc
2. FURADAN 10G	50	0	152a-d	160.4bc
3. FURADAN 10G + ROVRAL ST	50 + 12	0	139bcd	174.3abc
4. COUNTER 5G	50	0	130cd	162.3bc
5. COUNTER 5G + ROVRAL ST	50 + 12	0	135bcd	163.6bc
6. COUNTER ST + ROVRAL	15	0	171a-d	204.4a
7. COUNTER ST + VITAVAX	15	0	196a	205.5a
8. VITAVAX RS	15	0	152a-d	170.5abc
9. ROVRAL ST	15	0	140bcd	174.2abc
10. CHECK	-	0.3	173abc	158.1bc
11. EXP-80415A	5	0.1	151a-b	179.1abc
12. EXP-80415A	10	0.1	145bcd	154.6c
13. EXP-80415A	20	0	126d	152.9c
14. VITAVAX	-	0.3	163a-d	171.1abc
15. UBI-2608-3	1	0.3	126d	158.7bc
16. UBI-2608-3	2	0.3	144bcd	180.3abc
17. UBI-2608-3	3	0.3	136bcd	178.8abc
18. UBI-2608-3	4	0.3	155a-d	192.3ab
19. UBI-2608-3	8	0.2	181ab	185.1abc
20. CHECK	-	0.3	169a-d	165.9bc

* Means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

#033 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100104

CROP: Eggplant, cv. Blacknite

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
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TITLE: EFFECTS OF NOVODOR ON THE CONTROL OF COLORADO POTATO BEETLE (CPB), 1995

MATERIALS: NOVODOR (*Bacillus thuringiensis* var. *tenebrionis*); RIPCORD 400EC (cypermethrin); ADMIRE 240FS (imidacloprid)

METHODS: Plants were started in growth rooms in mid-April. They were transplanted at the Cambridge Research Station May 25, 1995, in 4-row plots, 5 m long, spaced 0.9 m apart. Plants were spaced 45 cm apart within a row. Plots were arranged in a complete randomized block design with 4 replications. Transplants were set with a one-row mechanical "Hollandia" transplanter. After transplantation, 100 ml of water was ladled on each plant for all treatments except ADMIRE where the appropriate amount of ADMIRE 240 FS was added to the water (3.1 ml/10 L planting water). Foliar insecticides were applied with a tractor-mounted, four-row boom sprayer that delivered 800 L/ha at 450 kPa.

There was a large population of Colorado potato beetle (CPB) adults in the plot area, requiring the application of adulticides to protect the young transplants. These foliar sprays were applied to all plots except the ADMIRE treatment, which received insecticide in the planting water. Three sprays were necessary to control the adult infestation: 1) May 31, VYDATE L (oxamyl), at 2.5 L/ha; 2) June 8, THIODAN 4EC (endosulfan), at 1.4 L/ha; and 3) June 16, RIPCORD 400EC (cypermethrin), at 87.5 ml/ha.

On June 20, 23 and 27, two egg masses of CPB were placed on five plants within each treatment to ensure a population of small larvae within each plot. The insecticides to be evaluated were applied on June 28, repeated June 29 due to rain after initial spray, July 4 and July 26. Population counts were taken twice weekly by checking 5 whole plants from the centre two rows of each plot. The number of CPB small larvae, large larvae, adults and estimated percent defoliation were recorded.

All four rows of each plot were harvested and fruit weighed on August 21. Data were subjected to 2-way analysis of variance and mean separation using Tukey's multiple range test (0.05% level).

RESULTS: As presented in table.

CONCLUSIONS: Both rates of NOVODOR and the ADMIRE treatment provided excellent control of CPB larvae and reduced the level of defoliation relative to the other treatments. RIPCORD was not efficacious.

Yield from the NOVODOR and ADMIRE plots were significantly greater than that of the unsprayed check plot. Yield from the RIPCORD plot was not significantly different from the Check.

Table 1. Mean* number of CPB large larvae (LL), percent defoliation (DEF) and yield of eggplant per 20 m of plot, 1995.

		July			July			August
		4	7	12	4	7	12	21
Treatment	g ai/ha	Large Larvae			Percent Defoliation			Yield (kg)
NOVODOR	4.5 L/ha	0.0b	0.0b	0.3b	15.3b	13.9c	35.5a	32.2b
NOVODOR	7.0 L/ha	0.0b	0.0b	0.4b	13.7b	13.9c	14.8b	38.5b
RIPCORD 400EC	35	0.7b	1.4a	3.2a	19.3b	28.5b	42.5a	20.1bc
ADMIRE 240FS	7.5 mg ai/pl	0.0b	0.0b	0.0b	2.3c	1.6d	2.0b	74.4a
Unsprayed check	----	3.9a	2.3a	1.6ab	45.5a	63.5a	51.5a	2.5c
ANOVA (P• 0.05)		---	---	---	----	----	----	----

* Means in each column followed by the same letter are not significantly different at P• 0.05 (Tukey's Studentized Range Test).

#034 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 84100737

CROP: Onion, cv. Prince

PEST: Onion maggot, *Delia antigua* (Meig.)

NAME AND AGENCY:
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TITLE: INSECTICIDE SEED COATINGS AND GRANULAR INSECTICIDE FOR ONION MAGGOT CONTROL

MATERIALS: DYFONATE 10 G (fonofos); LORSBAN 15 G (chlorpyrifos); AZTEC 2.1 G (phosetbupirin 2% + cyfluthrin (0.1%); TRIGARD 75% (cyromazine); LORSBAN 48% (chlorpyrifos); EXP-80415A 500 g/L (fipronil); PRO-GRO (carbathiin 30% + thiram 50%)

METHODS: The tests were done at the Holland Marsh, Ontario, on muck soil. The experimental plot was arranged in a randomized complete block design with four replications. Each two-row plot was 6 m long with a spacing of 40 cm between the rows. Commercial film seed coatings (Bejo FILMKOTE) were provided by Bejozaden Ltd., Warmenhuizen, Holland. The granular formulations were applied in the furrow at planting time (May 10, 1995) by adding them with the seed on a V-belt planter. Estimates for the effectiveness of treatments were made by counting the number of plants in each row to determine the initial stand on May 30 and then by examining one row in each plot twice weekly from June 12 to July 20 to determine onion maggot damage. On each sample date plants that were wilted from onion maggot damage were counted and removed. On July 24, the remaining plants were pulled and examined for onion maggot damage. On August 30 the second row of plants were pulled and examined for damage.

RESULT: Data are presented in Table 1.

CONCLUSION: All the seed treatments in combination with furrow treatments were effective in controlling the first generation of the onion maggot (Table 1). The LORSBAN granular treatment was not as effective as DYFONATE and AZTEC granular treatments. The LORSBAN seed treatment was not as effective as TRIGARD and EXP-80415A seed treatments. By the end of August there was high plant loss (85.4%) in the check due to a combination of onion maggot infestation and above-normal onion smut damage. There was less stand loss with the granular insecticide DYFONATE alone in combination with the seed treatments of TRIGARD and EXP-80415A.

Table 1. Initial stand, percent maggot damage and percent stand loss following the indicated granular and seed treatments at seeding.

Granular treatments	Rate kg ai/ha	Seed treatments	Rate g ai/kg	Initial plant count / 6 m row	% maggot damage* / 6 m row	% stand loss**
LORSBAN 15 G	1.1	LORSBAN	50	232e	6.0c***	40.0g
LORSBAN 15 G	1.1	TRIGARD	50	268ab	1.7c	45.9efg
AZTEC 2.1 G	0.5	LORSBAN	50	244de	1.6c	42.2fg
AZTEC 2.1 G	0.5	TRIGARD	50	250bcde	0.9c	51.3efg
DYFONATE 10 G	1.1	TRIGARD	50	248cde	1.1c	13.3h
LORSBAN 15 G	1.1	EXP-80415A	25	273a	3.3c	45.6efg
DYFONATE 10 G	1.1	EXP-80415A	25	257abcd	0.9c	18.5h
AZTEC 2.1 G	0.5	EXP-80415A	25	274a	1.8c	43.6fg
	---	LORSBAN	50	247cde	18.8b	61.2bcd
	---	TRIGARD	50	251bcde	4.5c	64.0bc
	---	EXP-80415A	25	263abcd	5.1c	69.7b
LORSBAN 15 G	1.1	----		260abcd	16.3b	55.0cde
DYFONATE 10 G	1.1	----		266abc	4.5c	22.6h
AZTEC 2.1 G	0.5	----		263abcd	3.6c	46.3efg
Check	---	----		249bcde	53.3a	85.4a
ANOVA (P• 0.05)				20	6.6	11.1

* Accumulative counts June 12, 15, 19, 21, 23, 28, 30, July 4, 6, 10, 13, 17, 20 and 24.

** 1st and 2nd generation final count August 30.

*** Means followed by the same letter are not significantly different (P• 0.05; LSD test).

#035 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 84100737

CROP: Onion, cv. Prince

PEST: Onion maggot, *Delia antiqua* (Meig.)

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TITLE: INSECTICIDE SEED COATINGS FOR ONION MAGGOT CONTROL

MATERIALS: TRIGARD 75% (cyromazine); LORSBAN 48% (chlorpyrifos); EXP-80415A 500 g/L (fipronil); PRO-GRO (carbathiin 30% + thiram 50%)

METHODS: The tests were done at the Holland Marsh, Ontario, on muck soil. The trial was arranged in a randomized complete block design with four replications. Commercial film seed coatings (Bejo FILMKOTE) were provided by Bejozaden Ltd., Warmenhuizen, Holland. Seed treated with PRO-GRO was applied in the furrow at planting time (May 10, 1995) by an Earthway precision garden seeder. Rows were 6 m long and spaced 40 cm apart. The number of plants in each row was counted for initial stand on June 5 and then examined twice weekly from June 12 to July 24 for onion maggot damage. On each sample date plants wilting from onion maggot were counted and removed. On July 26, the remaining plants were pulled and examined for onion maggot damage.

RESULTS: As presented in table.

CONCLUSION: The commercial seed treatments of TRIGARD and EXP-80415A were more effective than the seed treatment LORSBAN in controlling the first generation of the onion maggot. With the high level of maggot infestation (60.0%), the higher rates of the unregistered insecticides TRIGARD and EXP-80415A showed potential for onion maggot control.

Table 1. Initial stand and percent maggot damage, following the indicated seed treatment.

Seed Treatments	Rate (g ai/kg seed)	Initial plant count /6 m row	% maggot damage/6 m* Gen. 1
TRIGARD	25.0	195abc	16.7cd**
TRIGARD	50.0	176cd	4.6e
TRIGARD	75.0	158d	8.1de
LORSBAN	25.0	218a	38.0b
LORSBAN	50.0	179cd	22.5c
LORSBAN	75.0	207ab	24.5c
EXP-80415A	12.5	211ab	12.8de
EXP-80415A	25.0	195abc	12.8de
EXP-80415A	50.0	187bc	7.4e
Check	----	195abc	60.0a
ANOVA (P• 0.05)		25	9.2

* Accumulative counts June 12, 15, 19, 21, 23, 26, 28, 30, July 4, 6, 10, 13, 17, 20, 24 and 26.

** Means followed by the same letter are not significantly different (P• 0.05; LSD test).

#036 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 84100737

CROP: Onion, cv. Benchmark and cv. Stokes Exporter II

PEST: Onion maggot, *Delia antiqua* (Meig.)

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TITLE: PESTICIDES FOR ONION MAGGOT CONTROL

MATERIALS: DYFONATE 10 G (fonofos); LORSBAN 15 G (chlorpyrifos);
AZTEC 2.1 G (phosetbupirin 2.0% + cyfluthrin 0.1%);
PRO-GRO (carbathiin 30% + thiram 50%)

METHODS: Two trials were done at the Holland Marsh, Ontario, on muck soil. The two experimental plots were arranged in a randomized complete block design with four replications. In Trial 1, seed (Benchmark) was custom-coated PRO-GRO treated seed. The granular formulations were applied by using a Stan-Hay precision seeder in a bed of four double rows each measuring 24 m long on May 5, 1995. Each bed received three different rates of application of a granular treatment and in addition there was an untreated row. On June 1 an assessment of initial plant stand was based on the number of plants in each of two, 2-m segments in each row. The designated segments for the assessment of the first generation of onion maggot were checked twice weekly from June 12 to July 17 and damaged plants were counted and removed. On July 18, all plants were harvested from the same two, 2-m segments in each row and plants examined for onion maggot damage. At the end of the second and third generation for the onion maggot, all plants were harvested from the designated two, 2-m lengths in each row and plants were examined for onion maggot damage. On September 19, 5 m of each row were harvested for yield.

In Trial 2, each plot had two single rows measuring 6 m long and spaced 40 cm apart. In addition to the granular pesticides applied with the seed, all seed (Stokes Exporter II) was treated by shaking it with a dust formulation of PRO-GRO at 25 g/kg seed. The granular formulations were applied in the furrow at planting time (May 8, 1995) by adding them with the seed on a V-belt planter. Estimates of the effectiveness of treatments were made by counting the number of plants in one row of each plot to determine the initial stand on June 1 and then by examining the row twice weekly from June 12 to July 17 to determine onion maggot damage. On each date plants that were wilted from onion maggot damage were counted and removed. On July 19, the remaining plants were harvested and examined for onion maggot damage. The second row was harvested on September 19 to obtain estimates of yield.

RESULTS: As presented in tables.

CONCLUSIONS: In Trial 1, the higher rates of the granular insecticide LORSBAN and both rates of DYFONATE were effective in controlling the infestation of the first generation of onion maggot. The unregistered insecticide AZTEC was as effective as the registered insecticides. By the end of the third generation, the accumulative damage of the onion maggot had increased for all treatments. The stand loss was also attributed to above-normal onion smut infection. The highest rate of LORSBAN and both rates of DYFONATE had the lowest stand loss, as reflected in the yield.

With high maggot infestation (60.1%) in Trial 2, the registered insecticides DYFONATE and LORSBAN were not as effective as the unregistered granular insecticide AZTEC in controlling the first generation of onion maggot. Plants protected with the granular insecticide AZTEC had the highest yield.

Table 1. Trial 1 - Initial onion stand, percent maggot damage, percent stand loss and yield following the indicated treatment at seeding.

Treatments	Rate	Initial plant count	% Maggot damage	% Stand loss		Yield
	kg ai/ha	/6 m row	Gen 1*	Gen 1&2**	Gen 1,2,&3***	(kg/ha x 10^3)
Check	0	167bc	35.0a***	80.9a	82.7a	25.2d
LORSBAN 15G	1.1	165bc	19.2b	69.0bc	62.0b	34.3cd
	2.2	158cd	12.8bc	56.7d	50.9b	40.5bc
	4.5	177b	8.9c	35.8e	34.8c	60.9a
Check	0	162bc	38.2a	76.9ab	77.4a	25.9d
DYFONATE 10G	2.2	169bc	6.7c	40.7e	36.1c	51.1ab
	4.5	144d	7.1c	34.5e	25.0c	49.6ab
AZTEC 2.1G	0.5	193a	8.0c	61.2cd	55.9b	44.6bc
ANOVA (P• 0.05)		16	8.0	10.0	13.7	13.1

* Accumulative counts June 13, 16, 20, 23, 27, 30, July 4, 7, 11, 14, 18 and 20.

** 1st and 2nd generation final count August 31, 1st, 2nd and 3rd generations final count September 25.

*** Means followed by the same letter are not significantly different (P• 0.05; LSD test).

Table 2. Trial 2 - Initial stand, percent maggot damage and yield following the indicated treatment at seeding with a single-row seeder.

Treatments	Rate (kg ai/ha)	Initial plant count / 6 m row	% Maggot damage*	Yield (kg/ha x 10^3)
LORSBAN 15 G	1.1	173a	51.7b	15.5b
	2.2	151b	21.4c	16.0b
DYFONATE 10 G	1.1	184a	33.7c	9.0b
	2.2	178a	29.0c	14.4b
AZTEC 2.1 G	0.5	181a	8.3d	26.3a
Check		192a	60.1a	1.0c
ANOVA (P• 0.05)		21	12.3	7.3

* Accumulative counts June 13, 16, 20, 23, 27, 30, July 4, 7, 11, 14, 18 and 20.

** Means followed by the same letter are not significantly different (P• 0.05; LSD test).

#037 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 280-1252-9304

CROP: Onion, cooking, cv. Prince

PEST: Onion maggot, *Delia antiqua* (Meigen)

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TITLE: EVALUATION OF SEED- AND SEED FURROW INSECTICIDES FOR CONTROL OF TWO STRAINS OF ONION MAGGOT ATTACKING COOKING ONIONS IN ORGANIC SOIL

MATERIALS: EXP-80415A 500 E (fipronil); UBI-2627 175 SD (imidacloprid); LORSBAN 15 G (chlorpyrifos); LORSBAN 480 E (chlorpyrifos);
TRIGARD 75 WP (cyromazine), talc

METHODS: Commercial film seed coatings (Tmts. 1, 5-6) were applied by BEJOZADEN Ltd. in Warmenhuizen, Holland. Laboratory-applied seed treatments (Tmts. 2-3) were applied 8 May. Cooking onion seed moistened with liquid insecticide (Tmts. 2-3) was tumbled with inert talc, until seeds were uniformly coated. All seed was planted at the London Research Farm on 9 May in 3-row micro plots (2.25 m long x 0.9 m wide) filled with insecticide residue-free organic soil. All treatments were replicated three times in a randomized complete block design. Granular furrow insecticide (Tmt. 7) was hand-applied in a 2-3 cm band in the bottom of the furrow after the seed was planted but before the seed furrow was closed. On 2 June a total of 250 OM eggs from an insecticide-susceptible strain, originally collected on the Thedford Marsh (TM), were buried 1 cm deep beside one onion row in each plot. The infested row length was delineated by stakes and the number of onion plants was counted. Infestations to remaining rows were repeated on 7 and 13 June. On 13 June 250 eggs from an OM strain collected on the Holland Marsh (HM) were also buried along separate row lengths in Tmts. 1, 3, 4 and 8. Surviving onion plants were counted 4 weeks after each infestation and the percent loss calculated. Data were subjected to arcsin square root transformation prior to statistical analysis by ANOVA; significance of differences among treatments means was determined using Duncan's New Multiple Range Test. Significance of differences in damage to individual treatments, caused by maggots from the TM and HM strains in Infestation III was measured by t tests. Untransformed data are presented in Table 1. At harvest on 22 September, samples of onions and soil directly beneath growing onions were collected from Tmt. 4 for analysis of possible imidacloprid residues. Microplots for Tmt. 4 were then spaded and cultivated and additional soil samples collected on 26 September. All residues of imidacloprid were determined using HPLC by the Analytical Chemistry Services Group in the London laboratory of the Pest Management Research Centre.

RESULTS: As presented in the table.

CONCLUSIONS: For all infestations, all treatments proved at least as effective as furrow granular application of LORSBAN 15G, the commercial standard, significantly reducing loss of seedling onions to larvae emerging from introduced OM eggs. Poor egg production by the recently established HM strain prevented comparison of relative effectiveness of all treatments against both OM strains. The HM strain is known to be less susceptible to imidacloprid and other insecticides than the insecticide-susceptible TM strain. Increased seedling loss by maggots from the HM strain, for Tmts. 1, 3 and 4 after Infestation III, was not, however, statistically significant, possibly due to small sample size.

RESIDUES: The limit of detection for imidacloprid in both soil and onion was 0.05 ppm. Imidacloprid was not detected in onion harvest samples. At harvest, 136 d post-planting, imidacloprid at 0.83 ppm remained in soil directly beneath onions growing from seed treated with the insecticide at 50 g a.i./kg seed. Soil dilution following tillage operations reduced these residue levels to 0.30 ppm.

Table 1. Effect of seed- and seed furrow treatments on onion stand loss due to onion maggot.

No.	Insecticide Treatment	Rate (g a.i./kg seed)	Mean % Onion Loss after Indicated Infestation			
			Infest. I (2 Jun)	Infest. II (7 Jun)	Infest. III (13 Jun)	
					Thedford	Hol. Marsh
* 1	TRIGARD 75WP	50.0	29.1 b***	14.7 bc	2.8 b	11.2 b
2	LORSBAN 480E	50.0	8.7 bc	22.9 b	20.5 b	--****
3	UBI-2627 175SD	25.0	14.6 bc	3.6 bc	6.1 b	14.0 b
4	UBI-2627 175SD	50.0	3.6 c	1.2 c	3.2 b	10.7 b
* 5	EXP-80415A 500E	12.5	7.4 bc	11.4 bc	4.8 b	--
* 6	EXP-80415A 500E	25.0	6.7 c	0.9 c	4.3 b	--
7	LORSBAN 15G	4.8**	8.9 bc	11.7 bc	27.1 b	--
8	CONTROL	---	86.2 a	72.4 a	90.3 a	85.5 a

* Commercial application of seed coating.

** Seed furrow treatment applied as g a.i./100 m.

*** Means within a column followed by the same letter are not significantly different (P = 0.05) as determined by Duncan's New Multiple Range Test.

**** Comparison not done due to lack of eggs from Holland Marsh strain.

#038 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 84100737

CROP: Onion, cv. Benchmark

PEST: Onion thrips, *Thrips tabaci*

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TITLE: INSECTICIDE FOLIAR TREATMENT TO CONTROL THRIPS ON ONIONS

MATERIALS: DIAZINON 500 EC (diazinon); CYMBUSH 250 EC (cypermethrin); ADMIRE 240FS (imidacloprid), WARRIOR 120 EC (lambda-cyhalothrin); KARATE 50 EC (lambda-cyhalothrin)

METHODS: The tests were done at the Holland Marsh, Ontario, on muck soil. Onions were planted with a Stan-Hay precision seeder in a bed of four double rows. The experimental plot was arranged in a randomized complete design. The plots were two beds, 7 m long, replicated four times. The treatments were applied at 500 L/ha with a tractor-mounted sprayer at 600 kPa on August 7, 1995. The thrips population was assessed by examining ten onion plants in each plot. Nymphs and adults were counted on each leaf and the leaf was stripped to count thrips in the leaf axil.

RESULT: Results are presented in the Table below.

CONCLUSIONS: Three days after application, KARATE was the most effective in controlling the nymphal population. Three and 7 d after application, CYMBUSH, WARRIOR and KARATE controlled the onion thrips population more effectively than ADMIRE. DIAZINON or CYMBUSH was not effective in controlling the nymphal and adult populations of the onion thrips.

Table 1. Mean number of nymphal (N) and adult (A) thrips/10 plants after insecticide foliar application.

		Mean number of thrips/10 plants days after application					
				3		7	
	Rate	Pre-application					
Treatments	g/ai/ha	N	A	N	A	N	A
1 DIAZINON	750	113*	13a	104a	3ab	47a	1ab
2 CYMBUSH	70	130	7ab	37bc	0c	21bc	0b
3 ADMIRE	100	77	5b	69abc	1bc	36ab	2a
4 WARRIOR	10	97	4b	40bc	0c	11c	0b
5 KARATE	10	114	6ab	24c	1bc	13bc	0b
6 KARATE	12.5	83	9ab	30c	0c	11c	0b
6 Control	-----	49	4b	83ab	4a	21bc	1ab
ANOVA (P• 0.05)		ns	8	52	2	23	1

* Means followed by the same letter are not significantly different (P• 0.05; LSD test).

#039 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

PEST: Buckthorn aphid, *Aphis nasturtii* Kaltenbach
Potato aphid, *Macrosiphum euphorbiae* (Thomas)
Green peach aphid, *Myzus persicae* (Sulzer)

NAME AND AGENCY:
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TITLE: EFFECT OF ADMIRE ON THE SPREAD OF POTATO LEAF ROLL VIRUS

MATERIALS: ADMIRE 240 F (imidacloprid)

METHODS: Plots consisted of 14, 50 m long rows spaced 0.9 m apart. Treatments were arranged in a randomized block design with three replications. Potatoes were planted on May 26, 1995, at 0.46 m within row spacing. ADMIRE (0.03 g a.i./m row) was applied in-furrow by a gravity feed to the soil treatment at planting. Foliar pesticides were applied with a tractor-mounted hydraulic sprayer operating at 300 kPa, and equipped with three D4-45 nozzles/row, with an application volume of 450 L/ha and a speed of 6 kph. On June 10 a pre-emergence herbicide (LINURON, 2.5 L a.i./ha) was applied. Colorado potato beetle (CPB) adults were hand picked from all the plots on June 23. NOVODOR, (8 L a.i./ha) for CPB control, was applied to the Foliar and Check treatments on June 30, July 5, 10 and 14, to all treatments on July 21 and August 15, to the Soil and Check treatments on August 8 and to the Check treatment on August 18. ADMIRE (200 ml a.i./ha) was applied to the Soil treatment on July 12 and to the Foliar treatment on July 25 and August 8. DITHANE (2.2 kg a.i./ha) was applied to all plots to control late-blight on August 15, 18 and 25. The plots were top-killed with REGLONE (2.75 L a.i./ha) on Sept 5. The number of potato plants and the number of potato plants showing leaf roll virus symptoms per plot were counted on July 17 and August 25. Aphid flight into the plots was monitored with yellow pan traps. One trap was placed per plot between rows seven and eight, 15 m from the east or west end of the plot. Trap position alternated east and west between plots. Traps were emptied twice a week from June 20 to Sept 15, and the number of potato, buckthorn, green peach, and other aphids were counted. Data expressed as proportions were converted to the arcsine transformation before analyses of variance or t-tests. Detransformed means are presented.

RESULTS: There were no differences in the percentage of plants showing leaf roll virus symptoms between treatments on July 17 or August 25. Treatment means are presented in Tables 1 and 2.

CONCLUSIONS: The average percentage of potato plants infected with leaf roll virus as of July 17 was more than doubled by aphid spread in the unprotected check plots on August 25 (Table 1). Two applications of foliar ADMIRE at the beginning of the migration of the green peach aphid did not reduce the spread of leaf roll consistently (Table 1). The in-furrow application of ADMIRE with one foliar spray of ADMIRE prevented any leaf roll spread, while two foliar applications of ADMIRE were not as effective at preventing leaf roll spread. The addition of a foliar spray of ADMIRE to in-furrow ADMIRE treated plots resulted in a higher than label recommendation level of ADMIRE in this treatment. The results suggest that relatively high concentrations of ADMIRE are required to prevent leaf roll spread.

Table 1. Mean percentage of plants showing leaf roll symptoms on July 17 and August 25 per treatment.*

Date	Soil	Foliar	Check
July 17	4.2a	3.6a	3.3a
Aug 25	4.3a	5.6a	7.2b

* Figures are means of three replications. Numbers followed by the same letter in a column are not significantly different according to a t-Test (P• 0.05).

Table 2. Mean number potato, buckthorn, green peach and other aphids caught in yellow pan traps per treatment.*

Date	Potato			Green Peach			Buckthorn			Other		
	S	F	C	S	F	C	S	F	C	S	F	C
6/20	0.0	0.0	4.3	0.0	0.0	0.0	0.0	0.3	1.0	141.7	130.3	193.0
6/23	3.0	2.7	3.3	0.0	0.0	0.0	1.0	0.7	0.7	1.7	2.0	1.7
6/27	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	44.0	14.0	33.0
6/30	1.0	1.3	1.7	0.0	0.0	0.0	0.0	0.0	1.0	20.0	11.7	15.7
7/04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.0	68.3	43.0
7/07	0.7	2.3	0.7	0.0	0.0	0.0	0.7	0.3	0.3	27.3	19.7	19.3
7/11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	69.3	66.3	62.3
7/14	8.3	8.0	4.7	0.0	0.0	0.0	1.0	1.3	1.0	97.0	95.7	80.0
7/18	3.3	2.3	2.3	0.3	0.0	0.3	0.0	0.0	0.0	88.7	123.3	126.3
7/21	2.3	5.3	3.3	0.7	0.3	0.3	0.0	0.0	0.7	38.3	60.7	59.0
7/25	1.7	3.0	4.3	0.3	0.3	0.0	0.0	0.3	0.3	37.7	59.7	38.3
7/28	0.3	0.7	0.7	0.0	0.3	0.0	0.0	0.0	0.0	35.3	26.3	45.0
8/01	0.7	1.7	0.7	1.0	1.3	2.7	0.0	0.0	0.3	31.0	37.0	38.0
8/04	1.0	0.0	0.0	1.7	0.7	0.7	0.3	0.3	0.0	24.7	26.0	17.3
8/08	1.0	0.7	2.0	0.3	0.0	0.3	0.0	0.0	0.0	16.7	17.0	22.7
8/11	0.0	0.3	0.3	1.0	0.0	0.7	0.0	0.0	0.0	9.7	15.0	19.3
8/15	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	20.7	28.3	30.3
8/18	0.3	0.0	0.3	0.0	0.7	1.3	0.7	0.3	0.0	13.3	13.3	10.3
8/22	0.0	0.0	0.0	1.0	0.0	0.3	0.0	0.0	0.0	17.7	19.7	17.3
8/25	0.0	0.0	0.0	1.0	1.3	1.0	0.3	0.0	0.3	9.3	13.3	9.3
8/29	0.0	0.0	0.0	1.0	1.0	2.7	0.0	0.0	0.0	20.7	16.7	24.7
9/01	0.0	1.0	0.0	4.0	4.3	3.7	0.0	0.0	1.0	13.7	14.0	22.3
9/05	0.0	0.0	0.0	12.3	12.3	11.3	0.0	0.0	0.0	21.3	20.7	27.7
9/08	0.0	1.0	0.0	2.3	3.7	5.0	0.0	0.3	0.0	17.7	25.0	20.3
9/12	0.0	0.0	1.3	2.3	3.3	1.3	0.0	0.0	0.0	16.7	20.7	19.7

9/15	0.3	0.0	0.3	0.3	0.7	0.3	0.3	0.3	1.3	23.0	19.3	19.7

* Figures are means of three replications. No statistical analysis done.
S = Soil; F = Foliar; C = Check.

#040 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: ALTERNATIVE COLORADO POTATO BEETLE CONTROL TECHNIQUES

MATERIALS: NOVODOR FC (*Bacillus thuringiensis* var. *tenebrionis*); KRYOCIDE 96 W (sodium fluoaluminate); plastic (4 mil black mulching)

METHODS: Plots consisted of four 7.3 m long rows spaced at 0.9 m. The treatments were completely randomized with four replicates. Potatoes were planted June 1, 1995, at a within row spacing of 0.4 m. The inner edge of plastic-lined trenches were 0.9 m from the plots. The trenches were installed by June 9. Pesticides were applied with a tractor-mounted hydraulic sprayer operating at 300 kPa, equipped with three D4-45 nozzles per row, at an application volume of 450 L/ha and a speed of 6 kph. On June 10, a pre-emergence herbicide (LINURON, 2.5 L a.i./ha) was applied. On June 23 and 28, Colorado potato beetle (CPB) adults were hand-picked from all plots. The Trench treatment, which was to be kept within a defoliation rating of 3 (see Table 1) was sprayed with imidacloprid on July 14 and August 3. The other treatments were to kept within a defoliation rating of 2. NOVODOR was applied on June 30, July 4 and 10 to the NOVODOR and Trench/NOVODOR treatments. KRYOCIDE was applied on July 10, 17 and 28 to the KRYOCIDE and Trench/KRYOCIDE treatments. Imidacloprid maintenance sprays were applied to the Trench/NOVODOR and NOVODOR treatments on July 17 and August 3, and the Trench/KRYOCIDE and KRYOCIDE treatments on August 3. DITHANE (2.2 kg product/ha) was applied to all plots to control late-blight on August 18. CPB life stages were counted twice a week from June 29 to August 21 on 10 randomly chosen plants in the middle two rows of each plot. The defoliation rating of the middle two rows of a plot was taken twice a week from June 29 to Sept 5. The plots were top-killed with REGLONE (2.75 L product/ha) on Sept 5 and the middle two rows of each plot were harvested on Sept 20. Analyses of variance and Duncan's

Multiple Range Tests were carried out on the data.

RESULTS: As presented in the tables.

CONCLUSIONS: CPB adults were present before the plants had emerged and since CPB adults fly more when starved, the trenches were not as effective as expected (Table 1, June 29). As a result, the combination of plastic-lined trenches with NOVODOR or KRYOCIDE did not significantly improve yield protection compared to these two products used alone (Table 2). Both NOVODOR and KRYOCIDE kept defoliation to an acceptable level. Defoliation in these treatments only exceeded a rating of 2 after maintenance sprays had started. The large number of second instars in the Trench treatment on July 13 could be due to a larger proportion of the CPB adults colonized the trial field by flight than usual, for reasons stated above. Experimental design allowed a higher defoliation level in the Trench treatment than in the other treatments. This was accomplished by spraying the Trench treatment later than other treatments, resulting in a large number of CPB surviving to adulthood in the Trench treatment.

Table 1. The mean defoliation ratings of the middle two rows of the treatment plots throughout the sampling period.*

Treatment	June	July				August					Sept.
	29	6	13	20	27	3	10	17	24	31	5
Trench	4	1a	3	3	2	3	2	3	3	3	4
Trench/NOVODOR**	4	1a	1a	1a	2	2	2	3	3	3	3
NOVODOR**	5	1a	1a	1a	1a	2	2	2	2	2	3
Trench/KRYOCIDE***	2	1a	2	2	2	3	2	3	2	2	2
KRYOCIDE***	5	1a	1a	1a	2	2	1a	2	1a	1a	1a

* Figures are means of 4 replications. Defoliation rating:
0 - no defoliation
1 - 2-60% of plants with leaflets lightly damaged
1a - >60% "
2 - 2% of plants with • 1 compound leaf with • 50% defoliation
3 - 2-9% of plants with • 1 stem with • 50% defoliation
4 - 10-24% of plants "
5 - 25-49% of plants ".

** 4.7 L product/ha.

*** 13.5 kg product/ha.

Table 2. The mean number of various CPB life stages per 10 plants and the mean total weight yield in tonnes/hectare.*

Treatment	L2 13/07	L3 20/07	L4 27/07	Adults 14/08	Total Yield
Trench	68.8a	12.0	16.5b	21.0a	23.6ab
Trench/NOVODOR**	9.8b	6.0	10.3b	17.0ab	24.8a
NOVODOR**	8.8b	1.8	5.0b	5.0b	22.2ab
Trench/KRYOCIDE***	17.8b	15.5	37.3a	11.5ab	22.5ab
KRYOCIDE***	2.3b	0.8	20.3ab	5.0b	20.1b
ANOVA P• 0.05	---	ns	---	---	---

* Figures are means of 4 replications. Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

** 4.7 L product/ha.

*** 13.5 kg product/ha.

#041 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:

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TITLE: COLORADO POTATO BEETLE THRESHOLD, ALTERNATIVE AND TRADITIONAL CONTROL TECHNIQUES

MATERIALS: KARATE 50 EC (lambda-cyhalothrin);
WARRIOR 120 EC (lambda-cyhalothrin); NEWLEAF seed potatoes (*Bacillus thuringiensis* var. *tenebrionis* transgenic)

METHODS: Plots consisted of four 7.3 m long rows spaced 0.9 m apart. The treatments were completely randomized with four replicates (three in the 8 CPB/stem threshold treatment). Potatoes were planted June 1, 1995, at a within row spacing of 0.4 m. All pesticides were applied with a tractor-mounted hydraulic sprayer operating at 300 kPa, equipped with three disc and core (D4-45) nozzles per row, with an application volume of 450 L/ha and a speed of 6 kph. On June 10, LINURON (2.5 L product/ha) was applied as a pre-emergence herbicide. On June 23 and 28 Colorado potato beetle (CPB) adults were hand picked from the plants in all plots. KARATE and WARRIOR were applied on July 10, 17 and August 3. The 8 CPB/stem treatment was sprayed with imidacloprid when the mean number of CPB adults and larvae exceeded 8/stem, on July 17. Imidacloprid was used as a maintenance spray for the KARATE and WARRIOR treatments on August 10. DITHANE (2.2 kg product/ha) was applied to all plots to control late-blight on August 18. The number of CPB life stages were counted twice a week from June 29 to August 21 on 10 randomly chosen plants in the middle two rows of each plot in the KARATE and WARRIOR treatments, and during this period plus from August 24 to Sept 5 for the 8 CPB/stem and the NEWLEAF treatments. In the 8 CPB/stem treatment the number on stems of the 10 plants was counted. The defoliation rating for the middle two rows of a plot was taken twice a week from June 29 until Sept 5. The plots were top-killed with REGLONE (2.75 L of product/ha) on Sept 5 and the two middle rows of each plot were harvested on Sept 20. Analyses of variance and Duncan's Multiple Range Tests were carried out on the data.

RESULTS: As presented in the tables.

CONCLUSIONS: The 8 CPB/stem treatment had significantly larger CPB populations than other treatments (Table 1) because it was sprayed only once, on July 17. The large CPB population on the 8 CPB/stem treatment caused high defoliation (Table 2) and a significantly lower total yield than other treatments. KARATE and WARRIOR provided similar foliage and yield protection (Table 2). NEWLEAF was the best treatment at protecting foliage from the CPB. Defoliation in the NEWLEAF treatment was mainly from potato flea leaf beetles. Mean total yield from the NEWLEAF treatment plots was neither superior to the WARRIOR treatment nor significantly different from the KARATE and WARRIOR treatments, as would have been expected from the defoliation data.

Table 1. The mean number of various Colorado potato beetle life stages per 10 plants and the mean total weight yield.*

Treatment	Second Instars 13/07	Third Instars 17/07	Fourth Instars 03/08	Adults 14/08	Total Yield (tonnes/ha)
KARATE**	5.3b	20.0b	28.3b	5.0b	23.5a
WARRIOR**	2.8b	3.0b	15.0b	1.0b	26.6a
8 CPB/stem	47.3a	113.7a	121.7a	36.3a	16.2b
NEWLEAF	0.0b	0.0b	0.0b	0.3b	26.1a
ANOVA P• 0.05	---	---	---	---	---

* Figures are means of 4 replications (3 for the 8 CPB/stem treatment). Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

** 10 g a.i./ha.

Table 2. The mean defoliation ratings of the middle two rows of the treatment plots throughout the sampling period.*

Treatment	June	July				August					Sept.
	29	6	13	20	27	3	10	17	24	31	5
KARATE**	6	1a	2	1	1a	2	2	2	2	2	2
WARRIOR**	6	1a	1a	1a	1a	2	3	2	1a	1	1a
8 CPB/stem	7	1a	3	3	2	3	5	6	6	7	7
NEWLEAF	1	1	0	1	0	1	0	1	1	1	1

* Figures are means of 4 replications (3 for the 8 CPB/stem treatment) rounded to the nearest defoliation rating. Defoliation rating:

0 - no defoliation
1 - 2-60% of plants with leaflets lightly damaged
1a - >60% "
2 - 2% of plants with • 1 compound leaf with • 50% defoliation
3 - 2-9% of plants with • 1 stem with • 50% defoliation
4 - 10-24% of plants "
5 - 25-49% of plants "
6 - 50-74% of plants "
7 - 75-99% of plants "

** 10 g a.i./ha.

#042 REPORT NUMBER / NUMÉRO DU RAPPORT

BASE DE DONNÉES DES ÉTUDES: 86000718

CULTURE: Pomme de terre, cv. Superior

RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

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TITRE: ADMIRE À LA PLANTATION ET SUR LE FEUILLAGE: IMPACT SUR LE DORYPHORE DE LA POMME DE TERRE, SAISON 1995

PRODUITS: ADMIRE 240 FS (imidacloprid).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 1er juin 1995 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les séquences de pulvérisation des insecticides sont les suivantes selon les traitements; 1) ADMIRE/ADMIRE/ADMIRE sur le feuillage ; 2) ADMIRE à la plantation; 3) Témoin (sans traitement). ADMIRE a été appliqué le 1er juin (à la plantation) avec un pulvérisateur spécialement adapté à cette fin, le 29 juin et les 6 et 15 juillet (sur le feuillage) avec un pulvérisateur monté sur tracteur (pression: 1575 kPa, volume: 800 L/ha). L'intervalle entre les traitements sur le feuillage, au nombre maximum de trois, est de 7 jours à l'exception du dernier traitement qui a été réalisé à 9 jours. L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement pour chacune des parcelles à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 14 août avec du RÉGLONE (diquat, 2 fois 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 28 août.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: Les interventions avec ADMIRE, aussi bien au sol à la plantation que sur le feuillage en juin et juillet, se sont avérées dans l'ensemble très efficaces (Tableau 1). Les densités larvaires sont demeurées très basses en juillet et en août et cela est sensiblement identique pour le dommage. Les rendements obtenus sont très représentatifs de la performance d'ADMIRE, alors que chez le témoin il est beaucoup plus faible. En général, pour ADMIRE tous les résultats sont très significativement différents de ceux (densités, dommage et rendement) du témoin. ADMIRE, sur le feuillage avec trois applications initialement prévues au protocole, est tout aussi efficace que l'application à la plantation. De plus, il se révèle plus économique à l'achat, même si la dose d'ADMIRE au sol est de 833 ml/ha. Selon les résultats obtenus, deux interventions avec ADMIRE aurait été nettement suffisantes en 1995 puisque les densités larvaires sont demeurées très basses et relativement stables après le deuxième traitement. Idéalement, la troisième intervention aurait dû être déplacée vers la fin de juillet au lieu du 15 juillet. Toutefois, deux interventions en 1995 demeurent exceptionnelles, car les résultats de nos expériences passées avec ADMIRE et d'autres insecticides ont de base été optimum avec un minimum de trois interventions. Les résultats de l'emploi d'ADMIRE au sol sont cependant très intéressants. À la dose minimale de l'étiquette, la rémanence du produit est relativement longue, jusqu'à la mi-juillet; les densités et le dommage au feuillage ont progressivement augmenté jusqu'au 8 août. Une telle situation s'avère intéressante, car elle peut entraîner la nécessité en août d'une intervention contre des larves issues d'une colonisation tardive ou de la génération d'été. Ainsi, l'utilisation d'un autre moyen de lutte en fin de saison pourrait contribuer à retarder l'arrivée de populations de doryphores résistantes à ADMIRE. Enfin, considérant que la rémanence de ADMIRE au sol peut être variable et qu'une protection totale avec un seul produit toute la saison de production est non conforme avec un programme de lutte intégrée, la nécessité d'un traitement à dose élevée au sol à la plantation doit être repensée. À cet égard, ADMIRE pourrait être utilisé à une dose inférieure à 833 ml/ha, suffisante pour réduire uniquement la colonisation hâtive des champs en saison et permettre l'emploi de d'autres moyens de lutte. Selon les régions et la situation vécue, cela devrait être envisagé dans la perspective d'une approche durable.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1995.

Traitement Insecticide**	Population larvaire				Dommage*				Rendement
	juin	juillet		août	juin	juillet		août	(t/ha)
	28	11	24	08	29	14	27	08	
1. ADMIRE/ADMIRE/ ADMIRE (feuillage)	1,9ab***	0,8b	0,0b	0,5b	1,0a	0,0b	0,0c	1,0b	42,7a
2. ADMIRE (au sol)	0,0b	0,0b	1,0b	2,5a	0,0b	0,0b	0,7b	1,2b	43,9a
3. Témoin	2,3a	61,4a	9,5a	0,0b	1,0a	5,0a	6,0a	6,7a	14,5b

* Évaluation visuelle par parcelle: indice de défoliation de 0 à 8 (0 à 100% de défoliation).

** Doses: 1 = ADMIRE 200 ml p.c./ha; 2 = ADMIRE à la plantation, 833 ml p.c./ha (dose minimale de l'étiquette).

*** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

#043 REPORT NUMBER / NUMÉRO DU RAPPORT

BASE DE DONNÉES DES ÉTUDES: 86000718

CULTURE: Pomme de terre, cv. Superior

RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

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TITRE: ADMIRE EN ASSOCIATION AVEC NOVODOR ET GUTHION CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1995

PRODUITS: ADMIRE 240 FS (imidacloprid); NOVODOR FC (endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*, 3%); GUTHION 240 EC (azinphos-méthyl).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 1er juin 1995 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les séquences de pulvérisation des insecticides sont les suivantes selon les traitements: 1) ADMIRE/ADMIRE/ADMIRE; 2) ADMIRE/NOVODOR/ADMIRE; 3) NOVODOR/ADMIRE/GUTHION; 4) ADMIRE/GUTHION/ADMIRE; 5) GUTHION/ADMIRE/GUTHION; 6) Témoin (sans traitement). Ces produits ont été appliqués le 29 juin et les 6 et 15 juillet avec un pulvérisateur monté sur tracteur (pression: 1575 kPa, volume: 800 L/ha). L'intervalle entre les traitements est de 7 jours à l'exception du dernier traitement qui a été réalisé à 9 jours. L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement pour chacune des parcelles à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 14 août avec du RÉGLONE (diquat, 2 fois 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 28 août.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: Afin de comparer, l'association d'ADMIRE avec un insecticide biologique (NOVODOR) et un insecticide chimique (GUTHION), différents scénarios ont été expérimentés durant la saison 1995 (Tableau 1). Comme chacun de ces produits a un mode d'action qui lui est propre, il est important d'utiliser le moment opportun maximisant leur efficacité contre le doryphore de la pomme de terre lors d'applications sur le feuillage contre les larves. ADMIRE et NOVODOR, utilisés au premier ou au deuxième traitement principalement contre les petites larves, sont significativement plus efficaces que l'utilisation du GUTHION et le Témoin. Des traitements tardifs (3ième application) avec ADMIRE (no. 1 et 2) et GUTHION (no. 3 et 5) ont été significativement plus performants que le Témoin. Le traitement 4 avec ADMIRE pour la 3ième application s'est révélé moins efficace et cela est probablement attribuable à l'utilisation de GUTHION au 2ième traitement. Ainsi, la présence du GUTHION a généralement affaiblie la performance des associations qui incluent cet insecticide. NOVODOR a été plus efficace que GUTHION et peut aussi s'avérer un insecticide plus intéressant en association avec ADMIRE. Aucun dommage aux plants n'a été observé avec l'association ADMIRE/ADMIRE/ADMIRE, tandis que les autres traitements présentent des indices légèrement plus élevés mais très sécuritaires, sans impact sur les rendements. Les rendements de toutes les associations comparées ne diffèrent pas entre eux. Considérant les résultats obtenus, il serait certainement plus rentable d'inclure toujours avec ADMIRE des insecticides ou des moyens de lutte pour lesquels nous avons l'assurance de leur efficacité et d'un niveau de résistance du doryphore nul ou faible.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1995.

Traitement	Population larvaire				Dommage*				Rendement
Insecticide**	juin	juillet			juin	juillet		août	(t/ha)
	28	05	14	19	29	19	27	03	
1. ADMIRE/ADMIRE/ ADMIRE	1,9***	3,9c	0,0c	0,0c	1,0	0,0d	0,0c	0,0d	42,7a
2. ADMIRE/NOVODOR/ ADMIRE	2,1	3,9c	2,2c	0,3c	1,0	1,0c	0,3c	0,5c	40,2a
3. NOVODOR/ADMIRE/ GUTHION	2,7	6,7c	0,0c	0,0c	1,0	1,0c	0,0c	1,0b	41,7a
4. ADMIRE/GUTHION/ ADMIRE	2,2	3,8c	11,9b	2,5b	1,0	1,7b	0,7b	1,0b	39,5a
5. GUTHION/ADMIRE/ GUTHION	0,7	13,6b	0,1c	0,1c	1,0	0,7c	0,3c	1,0b	41,2a
6. TÉMOIN	2,3	24,1a	34,5a	32,4a	1,0	5,7a	6,0a	6,5a	14,5b

* Évaluation visuelle par parcelle: indice de défoliation de 0 à 8 (0 à 100% de défoliation).

** Doses: ADMIRE 200 ml p.c./ha; GUTHION 1,70 L p.c./ha; NOVODOR 7,0 L. p.c./ha

*** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

#044 REPORT NUMBER / NUMÉRO DU RAPPORT

BASE DE DONNÉES DES ÉTUDES: 86000718

CULTURE: Pomme de terre, cv. Superior

RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

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TITRE: ADMIRE: INTERVALLES ENTRE LES TRAITEMENTS CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1995

PRODUITS: ADMIRE 240 FS (imidacloprid).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 1er juin 1995 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les intervalles entre les traitements d'ADMIRE sont les suivantes: 1) 5 jours; 2) 7 jours; 3) 10 jours. La première intervention a été effectuée dès l'apparition des petites larves (10-30% d'éclosion des masses d'oeufs). ADMIRE a été appliqué le 29 juin (traitements 1, 2, 3), le 4 juillet (traitement 1), le 6 juillet (traitement 2), le 11 juillet (traitements 1 et 3) et le 15 juillet (traitement 2) avec un pulvérisateur monté sur tracteur (dose: 48 g m.a./ha), pression: 1575 kPa, volume: 800 L/ha). À noter que la troisième application des traitements 1 et 2 et la deuxième du traitement 3 ont été effectuées respectivement à 7, 9 et 12 jours en raison de la pluie ou du vent. L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement pour chacune des parcelles à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 14 août avec du RÉGLONE (diquat, 2 fois 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 29 août.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: Le choix judicieux de l'intervalle entre les traitements est nécessaire afin d'optimiser le succès des interventions contre le doryphore de la pomme de terre. Pour la saison 1995, l'application d'ADMIRE, quelque soit l'intervalle préconisé, a été très efficace pour réduire les densités larvaires durant la saison (Tableau 1). Comparativement au Témoin, les densités larvaires ont été maintenues à des niveaux significativement inférieurs pour tous les traitements avec ADMIRE en juin et juillet. Le dommage au feuillage a aussi été maintenu très bas et relativement stable à des niveaux n'ayant pas ou très peu d'incidence sur les rendements dont les résultats sont significativement plus élevés comparativement au Témoin. En regard des intervalles utilisés, les intervalles 5, 7 et 10 jours ont nécessité 3, 3 et 2 applications avec ADMIRE respectivement. Considérant la recommandation de l'étiquette qui limite à 2 le nombre d'applications foliaires, l'intervalle 10 jours serait le plus acceptable. Toutefois, cet intervalle est risqué entre la première et la deuxième interventions. Selon la saison, les densités et la rémanence de ADMIRE, le dommage peut s'accentuer dangereusement durant cette période. Ainsi, les densités (4,8 larves/plant; 46% L1 + L2 et 54% L3 + L4) et le dommage (1,5) les 10 et 11 juillet respectivement étaient significativement plus élevés par rapport aux intervalles 5 et 7 jours. Les intervalles 5 et 7 jours, en dépit d'une 3^{ième} application peu nécessaire en 1995, offrent une plus grande sécurité en début de saison. De ce fait, l'intervalle 7 jours serait probablement le plus rentable. Aussi, comme la première intervention a été faite hâtivement (10-30% d'éclosion des oeufs), un retard de quelques jours serait plus avantageux quelque soit l'intervalle. Enfin, selon les densités et la saison, une troisième intervention demeure toujours possible. Dans ce cas, ADMIRE pourra être utilisé en association avec d'autres insecticides efficaces.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1995.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	intervalle	juin	juillet			juillet			août	(t/ha)
	(jours)	28	10	14	24	03	11	24	03	
1. ADMIRE***	5	0,7**	0,3c	0,0b	0,0b	1,0	0,0d	0,0b	0,5bc	43,5a
2. ADMIRE	7	1,8	0,3c	0,0b	0,0b	1,0	0,5c	0,0b	0,0c	42,6a
3. ADMIRE	10	2,1	4,8b	0,4b	0,1b	1,0	1,5b	0,0b	0,7b	41,9a
4. TÉMOIN		1,0	43,6a	19.9a	10,7a	1,0	3,8a	5,0a	5,7a	18,9b

* Évaluation visuelle par parcelle: indice de défoliation de 0 à 8 (0 à 100% de défoliation).

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

*** Dose: Admire 200 ml p.c./ha.

#045 REPORT NUMBER / NUMÉRO DU RAPPORT

BASE DE DONNÉES DES ÉTUDES: 86000718

CULTURE: Pomme de terre, cv. Superior

RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

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TITRE: ADMIRE: STRATÉGIES D'INTERVENTION CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1995

PRODUITS: ADMIRE 240 FS (imidacloprid)

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 1er juin 1995 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. L'intervalle prévu entre les traitements d'ADMIRE est de 7 jours. La première intervention a été effectuée selon les stratégies de lutte suivantes: A) conventionnelle = 10-30 % d'éclosion des masses d'oeufs (traitement 1); B) boum d'éclosion = 6-9 jours après 10-30% d'éclosion des masses d'oeufs (traitement 2). Trois applications ont été effectuées pour le traitement 1, soit le 29 juin et les 6 et 15 juillet. Pour sa part, le traitement 2 n'a reçu que deux pulvérisations les 6 et 15 juillet. Tous les traitements ont été appliqués avec un pulvérisateur monté sur tracteur (dose: 48 g m.a./ha), pression: 1575 kPa, volume: 800 L/ha). À noter que la troisième application du traitement 1 et la deuxième du traitement 2 ont plutôt été effectués à un intervalle de 9 jours en raison du vent et de la pluie respectivement. L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement pour chacune des parcelles à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 14 août avec du RÉGLONE (diquat, 2 fois L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 29 août.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: La période d'intervention est très déterminante pour une bonne gestion des populations larvaires du doryphore de la pomme de terre (Tableau 1). Pour ce projet, la première intervention associée à la stratégie conventionnelle (A) a été faite contre les petites larves (2,0 larves/plant; 100% L1 + L2). Par contre, celle associée à la stratégie «boum d'éclosion» (B) a été effectuée 7 jours plus tard, alors que la population larvaire était composée de 16,8 larves/plant

(59,7% L1 + L2 et 40,3% L3 + L4). À ce moment, les densités étaient pour la stratégie B significativement plus élevé que pour la stratégie A et semblables au Témoin. Le maintien des populations a été similaire entre les deux stratégies de la mi-juillet jusqu'en août et très significativement différent par rapport au Témoin. De même, pour cette période les indices de dommage sont demeurés très bas et relativement très stables et de nouveau très significativement inférieurs à ceux du Témoin. Chez le Témoin, le dommage s'est accentué rapidement au début avec un indice élevé en fin de saison. Le rendement pour la stratégie A est légèrement plus élevé que celui de la stratégie B, mais de façon non significative. Quelque soit la stratégie, ADMIRE a donc été très performant avec des rendements significativement plus élevés que celui du Témoin. La stratégie «boum d'éclosion» avec seulement deux traitements comparativement à trois pour la stratégie conventionnelle semble tout aussi rentable et sécuritaire. De plus, une première intervention un peu plus hâtive et un intervalle un peu plus court entre la première et la deuxième applications pour la stratégie «boum d'éclosion» auraient sans doute été plus favorables considérant que la saison 1995 a été très chaude. La différence entre les rendements est probablement attribuable au dommage fait au feuillage en tout début de saison.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1995.

Traitement	Population larvaire				Dommage**				Rendement
Insecticide*	juin	juillet			juillet			août	(t/ha)
/stratégie	28	5	10	14	03	11	24	04	
1. ADMIRE/ conventionnelle	1,8***	4,0b	0,3b	0,0b	1,0	0,5c	0,0b	0,0c	42,6a
2. ADMIRE/ boum d'éclosion	2,3	16,8a	0,7b	0,2b	1,0	1,7b	0,3b	1,0b	39,4a
6. TÉMOIN	1,0	16,5a	43,6a	19,9a	1,0	3,7a	5,0a	5,7a	18,9b

* Dose: ADMIRE 200 ml p.c./ha.

** Évaluation visuelle par parcelle: indice de défoliation de 0 à 8 (0 à 100% de défoliation).

*** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

#046 REPORT NUMBER / NUMÉRO DU RAPPORT

BASE DE DONNÉES DES ÉTUDES: 86000718

CULTURE: Pomme de terre, cv. Superior

RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

NOM ET ORGANISME:
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TITRE: ESSAI D'INSECTICIDES CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1995

PRODUITS: ADMIRE 240 FS (imidacloprid); KRYOCIDE INSECTICIDE (fluoaluminate de sodium, 96,0%); NOVODOR FC (endotoxine-delta de *Bacillus Thuringiensis* var. *tenebrionis,* 3,0%); RIPCORD 400 EC (cyperméthrine); TRIGARD 75 WP (cyromazine).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 26 mai 1995, dans un sol de type loam sableux. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides ont été appliqués les 26 mai (traitement 1, à la plantation), 27 juin et 4 juillet (traitements 2, 3, 4 et 5), 11 juillet (traitements 3, 4 et 5) ainsi que le 21 juillet (traitement 4) avec un pulvérisateur monté sur tracteur (pression: 1575 kPa, volume: 800 L/ha). Pour le traitement 5, il y a eu 2 traitements avec TRIGARD (27 juin et 4 juillet) et le troisième avec RIPCORD (11 juillet). L'évaluation des densités du doryphore a été faite régulièrement sur 10 plants pris au hasard dans les 2 rangées du centre. Les dommages aux plants ont été évalués visuellement à l'aide d'un indice de défoliation de 0 à 8. Le défanage des plants a été effectué le 9 août avec du RÉGLONE (diquat, 2 fois 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 22 août.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: Tous les insecticides se sont révélés en 1995 très performants comparativement au Témoin (sans traitements). Les résultats (densités, dommage et rendement) sont dans l'ensemble significativement différents. Avec une saison très chaude, l'impact du doryphore s'est fortement manifesté en 1995 comme en témoignent les résultats (dommage et rendement) chez le Témoin (Tableau 1). Face à cette situation, la performance des insecticides est donc en général très évidente. Cependant, parmi les insecticides utilisés, par application foliaire, ADMIRE et KRYOCIDE ont occasionné, avec des résultats comparables, une réduction plus significative des densités et une protection du feuillage plus stable en saison et ce à des niveaux relativement faible (• 1). Les résultats obtenus avec NOVODOR et TRIGARD sont toutefois non négligeables considérant les densités et une première application faite un peu trop tardivement. Il y a eu pour ADMIRE, KRYOCIDE, NOVODOR et TRIGARD 2, 3, 4 et 3 traitements respectivement. Pour sa part, ADMIRE à la plantation a procuré une rémanence plus longue qu'en 1993 et 1994 car l'indice du dommage est demeuré très faible et stable jusqu'en août. Cela s'explique probablement par une saison estivale très peu pluvieuse. Le rendement obtenu avec ADMIRE à la plantation est significativement plus élevé que ceux obtenus avec les autres produits d'environ 5 à 7 t/ha. Même si l'envahissement par les adultes des parcelles dès la 3^{ième} semaine de juillet a sans aucun doute affecté légèrement les rendements pour les traitements 2, 3, 4 et 5, les résultats pour ces traitements démontrent que l'impact du doryphore sur les rendements n'est aucunement négligeable en dépit de densités et d'indices de dommage relativement bas pendant la saison. Enfin, ces produits offrent donc des opportunités intéressantes dans l'optique d'une approche durable.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1995.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	juin	juillet			juillet			août	(t/ha)
	(p.c./ha)	26	03	10	19	03	10	19	01	
1. ADMIRE	925,0 ml	0,0c**	0,0e	0,4d	0,2c	0,0c	0,0d	0,2d	0,2e	42,9a
2. ADMIRE	200,0 ml	14,6a	6,1d	0,1d	0,2c	1,0b	0,2d	0,0d	1,7c	38,3b
3. KRYOCIDE	11,0 kg	10,2ab	10,0cd	1,5d	0,9c	1,0b	1,0c	1,0c	1,2d	37,4b
4. NOVODOR	7,0 L	8,8b	11,9c	10,4b	12,1a	1,0b	1,0c	2,0b	3,0b	36,2b
5. TRIGARD	373,0 g	10,9ab	21,7b	5,8c	0,7c	1,0b	2,0b	2,0b	1,7c	37,7b
6. TÉMOIN***		10,3ab	39,0a	42,4a	4,6b	2,5a	6,2a	7,7a	8,0a	4,6c

* Évaluation visuelle par parcelle: indice de défoliation de 0 à 8 (0 à 100% de défoliation).

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

*** Aucun traitement insecticide.

#047 REPORT NUMBER / NUMÉRO DU RAPPORT

BASE DE DONNÉES DES ÉTUDES: 86000718

CULTURE: Pomme de terre, cv. Superior

RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

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TITRE: CYROMAZINE: INTERVALLE ENTRE LES TRAITEMENTS ET STRATÉGIES D'INTERVENTION CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1995

PRODUITS: TRIGARD 75 WP (cyromazine); GUTHION 240 EC (azinphos-méthyl).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 19 juin 1995 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. L'intervalle planifié entre les traitements de cyromazine est de 6 jours pour les traitements 1 et 3 et de 10 jours pour les traitements 2 et 4. La première intervention a été effectuée selon les stratégies de lutte suivantes: A) conventionnelle = 10-30% d'éclosion des masses d'oeufs (traitements 1, 2 et 5); B) boum d'éclosion = 6-9 jours après 10-30% d'éclosion des masses d'oeufs (traitements 3, 4 et 6). Deux applications de cyromazine (dose: 280 g m.a./ha ou 373 g p.c./ha) par traitement ont été effectuées, soit les 11 et 21 juillet (traitement 1 et 2), 21 et 27 juillet (traitement 3) et 21 juillet et 2 août (traitement 4). Les applications pour les traitements 5 et 6 (à l'exception du 11 juillet) ont été effectuées les 11, 21 et 27 juillet ainsi que les 2 et 10 août. Tous ces traitements ont été appliqués avec un pulvérisateur monté sur tracteur pression: 1575 kPa, volume: 800 L/ha). À noter que les traitements 1 (cyromazine A/6 jours) et 4 (cyromazine B/10) ont été retardés respectivement à 10 et 12 jours en raison de la pluie. De plus, les traitements de la stratégie B ont été réalisés 10 jours après 10-30% d'éclosion des masses d'oeufs. L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage aux plants a été évalué visuellement pour chacune des parcelles à l'aide d'un indice de défoliation de 0 à 8. Les plants de pomme de terre ont été défanés le 28 août avec du RÉGLONE (diquat, 2 fois 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 9 septembre.

RÉSULTATS: Voir le tableau ci-dessous. À noter qu'en raison de conditions météorologiques défavorables, les deux traitements de cyromazine de la stratégie A pour la deuxième application ont été faits avec le même intervalle de 10 jours.

CONCLUSIONS: L'efficacité de cyromazine en 1995, quelque soit l'intervalle entre les traitements ou la stratégie préconisée, est dans l'ensemble supérieure à celle du GUTHION. Les résultats (densités, dommage et rendement) pour cyromazine sont significativement différents de ceux obtenus chez le Témoin, sans traitements (Tableau 1). Des résultats comparables entre les traitements 1 et 2 (même intervalle pour le 2^{ième} traitement) témoignent d'une certaine régularité dans l'efficacité du produit. Pour cyromazine, il y a eu 2 applications comparativement à 5 (Témoin A) et à 4 (Témoin B) pour le GUTHION. Toutes les interventions faites avec cyromazine sont comparables, sans différences significatives, sauf pour les périodes du 18 et 25 juillet en regard des densités et du dommage respectivement pour la stratégie B. Cela est principalement dû au fait que les traitements pour la stratégie B ont débuté le 21 juillet, soit 10 jours après le boum d'éclosion des oeufs. À ce moment, les densités et les stades présents étaient très différents (9,1 larves/plant; 33,5% L1 + L2, 66,5% L3 + L4) de ceux des traitements 1 et 2 (2,0 larves/plant; 100% L1 + L2) avec des indices de dommage de 2,0 et 1,7 pour les traitements 3 et 4 respectivement. Même si les résultats avec cyromazine sont comparables, un intervalle court (inférieur à 10 jours) s'avère plus sécuritaire. La stratégie B (boum d'éclosion) demeure valable. Toutefois, l'intervalle doit être de 6-9 jours ou moins selon le développement de l'insecte et présenter un indice de dommage très inférieur à 2,0 lors du traitement. Selon la stratégie et l'intervalle utilisés, cyromazine s'avère donc un insecticide intéressant. Son emploi seul n'est pas acceptable et selon les saisons des traitements en association avec d'autres insecticides seront plus rentables.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1995.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Stratégie/ intervalle (jours)	juillet 11	18	27	août 10	juillet 14	25	août 07	18	(t/ha)
1. CYROMAZINE	A/6	2,8**	2,8cd	0,4b	2,6b	1,3	1,0c	1,0d	2,0c	34,5a
2. CYROMAZINE	A/10	1,2	1,8d	0,6b	2,8b	1,0	1,0c	1,0d	2,0c	34,1a
3. CYROMAZINE	B/6	3,2	6,3b	2,8b	0,1c	1,0	2,7a	1,0d	2,0c	33,0a
4. CYROMAZINE	B/10	2,0	9,0ab	2,7b	1,3bc	1,0	2,3b	1,0d	1,7c	32,6a
5. TÉMOIN A***	A	1,8	5,8bc	16,5a	5,4a	1,0	3,0a	2,0c	3,0b	31,1ab
6. TÉMOIN B***	B	4,1	11,1a	15,8a	5,6a	1,3	3,3a	3,0b	4,0ab	27,4bc
7. TÉMOIN (-)	---	2,2	7,8ab	16,2a	6,2a	1,0	2,7a	4,0a	5,0a	25,8c

* Évaluation visuelle par parcelle: indice de défoliation de 0 à 8 (0 à 100% de défoliation).

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

*** Témoin = insecticide chimique (GUTHION, dose 1,70 L p.c./ha).

#048 REPORT NUMBER / NUMÉRO DU RAPPORT

BASE DE DONNÉES DES ÉTUDES: 87000221

CULTURE: Pomme de terre, cv. Superior

RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

NOM ET ORGANISME:
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TITRE: M-TRAK ET NOVODOR, INSECTICIDES BIOLOGIQUES CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1995

PRODUITS: M-TRAK LI (endotoxine-delta encapsulée de *Bacillus thuringiensis* var. *san diego*, 10%); NOVODOR FC (endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*, 3%); insecticides chimiques commerciaux (DECIS 5,0 EC, GUTHION 240 EC, RIPCORD 400 EC).
MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions pour chacun des deux sites (A et B). Les pommes de terre ont été plantées le 26 mai 1995 (site A) et le 19 juin (site B). Pour chacun des sites, les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides biologiques (M-TRAK et NOVODOR) et chimiques (séquence des produits: site A = GUTHION - RIPCORD - DECIS - GUTHION; site B = GUTHION uniquement) ont été appliqués aux dates suivantes: site A = 27 juin, 4, 11 et 21 juillet; site B = 11, 21 et 27 juillet, 2 et 10 août (insecticide chimique seulement). Les produits ont été appliqués à l'aide d'un pulvérisateur monté sur tracteur pression: 1575 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été faite sur 10 plants pris au hasard dans les 2 rangées du centre. Les dommages aux plants ont été évalués visuellement à l'aide d'un indice de défoliation de 0 à 8. Le défanage des plants a été effectué le 9 août (site A) et le 28 août (site B) avec du RÉGLONE (diquat, 2 fois 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 28 août (site A) et le 6 septembre (site B).

RÉSULTATS: Voir les tableaux 1 et 2 ci-dessous. Il est important de mentionner que les densités du doryphore ont été plus sévères pour le site A comparativement au site B. De plus, la colonisation des parcelles au printemps a été plus agressive pour le site A. Ainsi lors du premier traitement les densités larvaires (site A = 8,0 larves/plant; site B = 3,8 larves/plant) étaient très différentes. Enfin, l'intervalle entre les traitements a été dans l'ensemble des projets égal ou supérieur à 7 jours.

CONCLUSIONS: Les résultats obtenus au Québec depuis déjà quelques années ont toujours très nettement démontré le potentiel d'utilisation des insecticides biologiques contre le doryphore de la pomme de terre en présence de populations résistantes aux insecticides chimiques homologués. En 1995, saison très difficile et particulière considérant le développement rapide de l'insecte en présence d'un été très chaud, les résultats confirment de nouveau ce potentiel. En effet, les résultats des tableaux 1 et 2 pour M-TRAK et NOVODOR au niveau des densités larvaires et de la protection du feuillage sont significativement très différents du Témoin et des insecticides chimiques. Les indices de dommage sont généralement plus faibles et plus stables avec les insecticides biologiques. Les rendements obtenus avec M-TRAK et NOVODOR, bien que non significativement différents de ceux des Témoin +, sont tout de même de moyennement (tableau 1) à légèrement (tableau 2) plus élevés. En regard des indices de dommage, l'efficacité de M-TRAK serait supérieure à NOVODOR, principalement en présence de densités élevées. Ainsi, au tableau 1 (infestation sévère et agressive) M-TRAK a assuré une meilleure protection du feuillage à partir du 10 juillet avec des indices de dommage significativement plus faibles qu'avec NOVODOR. Au tableau 2 (infestation faible et moins agressive), l'efficacité est comparable. L'emploi seul du M-TRAK et du NOVODOR demeurera toujours critique considérant qu'ils sont à la base plus efficaces contre les petites larves. Leur performance sera accrue par un emploi stratégique en association avec d'autres moyens (ADMIRE, KRYOCIDE...) de lutte.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1995.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	juin	juillet			juillet			août	(t/ha)
	(p.c./ha)	26	03	10	19	03	10	19	01	
A-1. M-TRAK	7,5 L	7,2**	8,6c	5,5c	2,9c	1,0c	1,0d	1,0d	1,5d	34,1a
A-2. NOVODOR	7,0 L	8,8	10,5c	4,6c	6,7b	1,0c	1,7c	2,0c	2,0c	36,2a
A-3. TÉMOIN +***		13,2	39,0b	33,0b	10,1a	1,5b	3,7b	3,5b	3,2b	25,4a
A-4. TÉMOIN -***		8,6	49,6a	53,7a	5,2bc	2,0a	6,2a	8,0a	8,0a	3,1b

* Évaluation visuelle par parcelle: indice de défoliation de 0 à 8 (0 à 100% de défoliation).

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

*** Témoin + = insecticides chimiques (DECIS, 150 ml p.c./ha; GUTHION 1,7 L p.c./ha; RIPCORD, 125 ml p.c./ha) selon la séquence suivante: GUTHION - RIPCORD - DECIS - GUTHION; Témoin = aucun traitement.

Table 2. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1995.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	juillet			août	juillet		août		(t/ha)
	(p.c./ha)	11	20	31	09	14	25	07	18	
B 1. M-TRAK	7,5 L	4,0**	1,4b	0,1c	0,1b	1,0a	1,0b	1,0c	1,0c	32,5a
B 2. NOVODOR	7,0 L	3,7	1,6b	0,9c	0,3b	1,0a	1,0b	1,0c	1,0c	34,0a
B 3. TÉMOIN +***		1,8	8,2a	13,5b	5,4a	1,0a	3,0a	2,0b	3,0b	31,1ab
B 4. TÉMOIN -***		2,1	8,1a	23,1a	6,2a	1,0a	2,7a	4,0a	5,0a	25,8b

* Évaluation visuelle par parcelle: indice de défoliation de 0 à 8 (0 à 100% de défoliation).

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

*** Témoin + = insecticide chimique, dose de l'étiquette (GUTHION, 1.7 L p.c./ha); Témoin - = aucun traitement.

#049 REPORT NUMBER / NUMÉRO DU RAPPORT

BASE DE DONNÉES DES ÉTUDES: 87000221

CULTURE: Pomme de terre, cv. Superior

RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

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TITRE: M-TRAK EN ASSOCIATION AVEC KRYOCIDE, SAISON 1995

PRODUITS: M-TRAK LI (endotoxine-delta encapsulée de *Bacillus thuringiensis* var. *san diego*, 10%); KRYOCIDE (fluoaluminate de sodium, 96%); insecticides chimiques commerciaux (DECIS 5,0 EC, GUTHION 240 EC, RIPCORD 400 EC).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 26 mai 1995. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides ont été appliqués le 27 juin et les 4 et 11 juillet (traitement 1, 2, 3, 4 et 5) et 21 juillet (traitement 1 et 5) avec un pulvérisateur monté sur tracteur pression: 1575 kPa, volume: 800 L/ha). Pour le traitement 2, M-TRAK a été appliqué le 22 juin et le 4 juillet contre les petites larves (L1 + L2) et KRYOCIDE le 11 juillet contre les grosses larves (L3 + L4). L'évaluation des densités du doryphore a été faite sur 10 plants pris au hasard dans les 2 rangées du centre. Les dommages aux plants ont été évalués visuellement à l'aide d'un indice de défoliation de 0 à 8. Le défanage des plants a été effectué le 9 août avec du RÉGLONE (diquat, 2 fois 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 23 août.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: L'emploi stratégique de différents moyens de lutte permet de contrer le phénomène de la résistance aux insecticides et d'orienter une approche durable. Dans cette optique l'association stratégique M-TRAK et KRYOCIDE dans la lutte au doryphore peut être intéressante. Ainsi, en regard des évaluations faites en 1995, les résultats démontrent hors de tout doute le potentiel d'utilisation de M-TRAK et KRYOCIDE en association dans le temps. Par rapport aux insecticides chimiques utilisés, les résultats (densités, dommage et rendement) obtenus avec M-TRAK, KRYOCIDE et M-TRAK/KRYOCIDE sont significativement très différents (Tableau 1). M-TRAK, KRYOCIDE et M-TRAK/KRYOCIDE ont procuré une protection du feuillage toute la saison avec des indices de dommage relativement stables et faibles. Les résultats sont dans l'ensemble comparables entre eux. KRYOCIDE avec seulement 3 applications comparativement à 4 avec M-TRAK et à 3 avec M-TRAK/KRYOCIDE a offert la meilleure performance. De plus, le rendement est significativement plus élevé que celui obtenu avec M-TRAK et légèrement différent de M-TRAK/KRYOCIDE. Bien que la performance de M-TRAK et de KRYOCIDE soit très intéressante, l'association M-TRAK/KRYOCIDE demeure justifiée considérant que ces deux produits ont des modes d'action très différents. D'autre part, selon les densités, l'association pourrait être M-TRAK/KRYOCIDE/KRYOCIDE au lieu de M-TRAK/M-TRAK/KRYOCIDE et même M-TRAK/KRYOCIDE/ADMIRE.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1995.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	juin	juillet			juillet			août	(t/ha)
	(p.c./ha)	26	03	10	19	03	10	19	01	
1. M-TRAK	7,0 L	7,2ab**	8,6c	5,5c	2,9c	1,0c	1,0c	1,0c	1,5c	34,1b
2. M-TRAK + KRYOCIDE	7,5 L 11,0 kg	9,6ab	4,7c	5,4c	0.3d	1,0c	1,0c	1,2c	1,5c	36,7ab
3 KRYOCIDE	11,0 kg	5,9b	8,5c	2,5c	0,3d	1,0c	1,0c	1,0c	1,2c	38,7a
4. TÉMOIN +***		13,2a	39,0b	33,0b	10,1a	1,5b	3,7b	3,5b	3,2b	25,4c
5. TÉMOIN -***		8,6ab	49,6a	53,7a	5,2b	2,0a	6,2a	8,0a	8,0a	3,1d

* Évaluation visuelle par parcelle: indice de défoliation de 0 à 8 (0 à 100% de défoliation).

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

*** Témoin + = insecticides chimiques (DECIS, 150 ml p.c./ha; GUTHION 1,7 L p.c./ha; RIPCORD, 125 ml p.c./ha) selon la séquence suivante: GUTHION - RIPCORD - DECIS - GUTHION; Témoin = aucun traitement.

#050 REPORT NUMBER / NUMÉRO DU RAPPORT

BASE DE DONNÉES DES ÉTUDES: 87000221

CULTURE: Pomme de terre, cv. Superior

RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

NOM ET ORGANISME:
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TITRE: NOVODOR EN ASSOCIATION AVEC KRYOCIDE, SAISON 1995

PRODUITS: NOVODOR FC (endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*, 3%); KRYOCIDE (fluoaluminate de sodium, 96%); insecticides chimiques commerciaux (DECIS 5,0 EC, GUTHION 240 EC, RIPCORD 400 EC).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 26 mai 1995. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides ont été appliqués le 27 juin les 4 et 11 juillet (traitement 1, 2, 3, 4 et 5) et 21 juillet (traitement 1 et 5) avec un pulvérisateur monté sur tracteur pression: 1575 kPa, volume: 800 L/ha). Pour le traitement 2, NOVODOR a été appliqué le 27 juin et le 4 juillet contre les petites larves (L1 + L2) et KRYOCIDE le 11 juillet contre les grosses larves (L3 + L4). L'évaluation des densités du doryphore a été faite sur 10 plants pris au hasard dans les 2 rangées du centre. Les dommages aux plants ont été évalués visuellement à l'aide d'un indice de défoliation de 0 à 8. Le défanage des plants a été effectué le 9 août avec du RÉGLONE (diquat, 2 fois 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 23 août.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: L'emploi stratégique de différents moyens de lutte permet de contrer le phénomène de la résistance aux insecticides. Cela contribue à une approche durable. Dans cette optique, l'association stratégique NOVODOR et KRYOCIDE dans la lutte au doryphore peut être intéressante. Ainsi, en regard des évaluations faites en 1995 pour une deuxième saison, les résultats démontrent de nouveau le potentiel d'utilisation de NOVODOR et KRYOCIDE en association dans le temps. NOVODOR seul a été un peu moins performant qu'en 1994. L'indice de dommage n'est pas demeuré stable à 1 et a augmenté jusqu'à l'indice 2. Par contre l'association avec KRYOCIDE à partir du 11 juillet a été bénéfique comme en témoigne l'indice de dommage le 19 juillet significativement plus faible que celui obtenu avec NOVODOR seul et sensiblement égal à KRYOCIDE seul. L'impact du KRYOCIDE sur les grosses larves semble donc toujours plus important que celui obtenu avec NOVODOR, produit d'emploi plus spécifique contre les petites larves. Ainsi, les densités larvaires sont significativement plus faibles à la mi-juillet pour les traitements 2 et 3 (KRYOCIDE) comparativement à NOVODOR (traitement 1). D'autre part, la performance de KRYOCIDE utilisé seul, confirme de nouveau son efficacité. L'indice de dommage au feuillage est demeuré très faible et stable toute la saison avec seulement 3 applications comparativement à 4 pour NOVODOR. L'efficacité de l'association NOVODOR/KRYOCIDE, considérant le développement rapide du doryphore en 1995 aurait peut être été meilleure avec 1 NOVODOR et 2 KRYOCIDE. L'emploi stratégique NOVODOR/KRYOCIDE est donc très justifié et très rentable, d'autant plus que l'efficacité est dans l'ensemble supérieure aux insecticides chimiques avec 4 applications. Cela illustre la résistance évidente du doryphore à ces produits.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1995.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	juin	juillet			juillet			août	(t/ha)
	(p.c./ha)	26	03	10	19	03	10	19	01	
1. NOVODOR	7,0 L	8,8ab**	10,5c	4,6cd	6,7b	1,0c	1,7c	2,0c	2,0c	36,2a
2. NOVODOR + KRYOCIDE	7,0 L 11,0 kg	10,0ab	11,5c	7,7c	0,5d	1,0c	1,2d	1,2d	1,7c	38,3a
3. KRYOCIDE	11,0 kg	5,9b	8,5c	2,5d	0,3d	1,0c	1,0d	1,0d	1,2d	38,7a
4. TÉMOIN +***		13,2a	39,0b	33,0b	10,1a	1,5b	3,7b	3,5b	3,2b	25,4b
5. TÉMOIN -***		8,6ab	49,6a	53,7a	5,2c	2,0a	6,2a	8,0a	8,0a	3,1c

* Évaluation visuelle par parcelle: indice de défoliation de 0 à 8 (0 à 100% de défoliation.

** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

*** Témoin + = insecticides chimiques (DECIS, 150 ml p.c./ha; GUTHION 1,7 L p.c./ha; RIPCORD, 125 ml p.c./ha) selon la séquence suivante: GUTHION - RIPCORD - DECIS - GUTHION; Témoin = aucun traitement.

#051 REPORT NUMBER / NUMÉRO DU RAPPORT

BASE DE DONNÉES DES ÉTUDES: 87000221

CULTURE: Pomme de terre, cv. Superior

RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say).

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TITRE: STRATÉGIE D'INTERVENTION BASÉE SUR LE «BOUM D'ÉCLOSION» DES OEUFS, SAISON 1995

PRODUITS: M-TRAK LI (endotoxine-delta encapsulée de *Bacillus thuringiensis* var. *san diego*, 10%); NOVODOR FC (endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*, 3%); GUTHION 240 EC (azinphos-méthyl).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées tardivement le 19 juin 1995 considérant que la première plantation (26 mai) a présenté d'importants problèmes de manques à la levée. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides ont été appliqués selon deux stratégies de lutte (conventionnelle = première intervention dès l'apparition des petites larves (L1) à environ 10-30% d'éclosion des oeufs; «boum d'éclosion» des oeufs = première intervention a lieu 6-9 jours après le «boum d'éclosion» (10 - 30%) les 11 juillet (traitements 1, 2 et 3), 21 et 27 juillet et 2 août (traitements 1, 2, 3, 4, 5, et 6) et le 10 août (traitements 2 et 5). Les produits ont été appliqués à l'aide d'un pulvérisateur monté sur tracteur pression: 1575 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été faite sur 10 plants pris au hasard dans les 2 rangées du centre. Les dommages aux plants ont été évalués visuellement à l'aide d'un indice de défoliation de 0 à 8. Les masses d'oeufs (10 masses/parcelle) ont été suivies régulièrement afin de pouvoir initier les premiers traitements selon les stratégies utilisées. Les plants ont été défanés le 28 août avec du REGLONE (diquat, 2 fois 2 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 6 septembre.

RÉSULTATS: Voir le tableau ci-dessous. Pour ce projet, les densités et le dommage à la récolte ont été plus faibles en dépit d'une saison très favorable au développement du doryphore. Cela est attribuable à la date tardive de plantation.

CONCLUSIONS: Afin de réduire l'utilisation des insecticides et d'optimiser leur emploi, il est très important d'intervenir au bon moment. Dans le cadre de ce projet de recherche, dont les travaux en parcelles expérimentales sont complémentaires de ceux effectués en champs commerciaux, deux stratégies d'intervention ont été évaluées pour une deuxième saison à l'aide d'insecticides chimiques et biologiques. Comparativement à la saison 1994, la stratégie associée au «boum d'éclosion» des oeufs s'est révélée un peu moins performante pour la saison 1995, et ce quelque soit l'insecticide utilisée. En effet, pour M-TRAK, NOVODOR et GUTHION les indices de dommage avec la stratégie «boum d'éclosion» en juillet et août sont moins stables et légèrement supérieurs à la stratégie conventionnelle. De même, les rendements sont en général légèrement à la baisse comparativement à la stratégie conventionnelle. En 1995, avec l'approche «boum d'éclosion» la première intervention a été faite un peu trop tardivement, soit 10 jours après celle établie pour l'approche conventionnelle et ce, à un niveau moyen de densités larvaires le 20 juillet pour M-TRAK et NOVODOR de 11,4 larves/plant (39,5% L1 + L2, 60,5% L3 + L4). En 1994, l'intervalle entre les deux stratégies étaient de 7 jours avec un % plus élevé de petites larves (91,2% L1 + L2, 8,8% L3 + L4). L'emploi de M-TRAK, NOVODOR et GUTHION a tout de même nécessité seulement trois, trois et quatre interventions respectivement avec l'approche «boum d'éclosion» comparativement à quatre, quatre et cinq avec l'approche conventionnelle. Comme en 1994, quelque soit l'approche, cela nécessite l'emploi d'insecticides très performants. Ainsi, comparativement à GUTHION, les insecticides biologiques M-TRAK et NOVODOR se sont révélés de beaucoup supérieurs. Les résultats sur les densités larvaires et le dommage aux plants sont dans presque tous les cas significativement plus faibles avec M-TRAK et NOVODOR pour les deux approches préconisées. Enfin, l'applicabilité au Québec de l'approche «boum d'éclosion» pour être acceptable nécessitera une adaptation afin de toujours favoriser une première intervention un peu plus hâtivement en présence d'un faible pourcentage (• 10%) de grosses larves.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1995.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	juillet			août	juillet		août		(t/ha)
/stratégie**	(p.c./ha)	11	20	31	09	18	27	07	18	
1. M-TRAK/conv.	7,5 L	4,0***	1,4c	0,0c	0,1b	1,0b	1,0c	1,0d	1,0d	32,5ab
2. GUTHION/conv.	1,7 L	1,8	8,2b	13,5b	5,4a	1,7a	2,5a	2,0c	3,0b	31,1ab
3. NOVODOR/conv.	7,0 L	3,7	1,6c	0,9c	0,3b	1,0b	1,0c	1,0d	1,0d	34,0a
4. M-TRAK/b.d'é.	7,5 L	1,6	8,9b	0,9c	0,4b	1,7a	1,5bc	1,0d	1,5cd	31,0abc
5. GUTHION/b.d'é.	1,7 L	4,1	13,1a	20,7a	5,6a	2,0a	3,0a	3,0b	4,0ab	27,4bc
6. NOVODOR/b.d'é.	7,0 L	2,8	14,0a	2,7c	0,7b	2,2a	1,7b	1,0d	1,7c	32,2ab
7. TÉMOIN		2,1	8,1b	23,1a	6,2a	2,2a	2,7a	4,0a	5,0a	25,8c

* Évaluation visuelle par parcelle: indice de défoliation de 0 à 8 (0 à 100% de défoliation).

** Stratégie de lutte: conventionnelle (conv.) = premier traitement environ 10-30% d'éclosion des oeufs; «boum d'éclosion» (b.d'é.) = premier traitement 6-9 jours après le boum d'éclosion des oeufs (30%).

*** Les résultats sans lettre ou suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

#052 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: MANAGEMENT OF THE COLORADO POTATO BEETLE (CPB) ON POTATOES

MATERIALS: NOVODOR 3% (*Bacillus thuringiensis* var. *tenebrionis*); KRYOCIDE 96% (sodium fluoaluminate); KARATE 50 EC; WARRIOR 120 EC (lambda-cyhalothrin); THIODAN 400 EC (endosulfan)

METHODS: Small, whole seed pieces were planted at Harrington, Prince Edward Island, on May 17, 1995. Plants were spaced 0.4 m within rows and 0.9 m between rows in 4-row plots. Plots were 7.6 m long and 3.6 m wide, and were separated from each other by 1.8 m of cultivated soil. Plots were arranged in a randomized complete block design with seven treatments each replicated a total of four times. Treatments were applied as foliar sprays in a mixture equivalent to 303 L/ha at a pressure of approximately 240 kPa using a CO_2 pressurized precision-plot sprayer. First sprays were timed to coincide with about 50% hatch of the CPB egg masses (July 7). The following additional sprays were applied when a threshold of 1 CPB per net sweep was surpassed: NOVODOR at 4.7 L/ha and at 7.1 L/ha on July 11, 18, 26, August 1 and 9; KARATE and THIODAN on July 11, 26 and August 9; KRYOCIDE on July 11, 18 and August 9; and WARRIOR on July 11, August 1 and 9. Each week from June 28 to August 14, the number of early instars (L1-L2), late instars (L3-L4), and adults of the CPB from 10 net sweeps (0.37 m diameter) were counted from the centre 2 rows of each plot. Percent defoliation was recorded weekly from July 14 to August 18. Weeds were controlled with an application of metribuzin at 750 g a.i./ha on May 27, 1995. Plots received recommended applications of chlorothalonil at 1.25 kg a.i./ha for control of late blight. Plots were sprayed with oxamyl at 720 g a.i./ha on August 16 terminate insect activity in all plots and with diquat at 370 g a.i./ha on August 28 for top desiccation. Tubers from the centre 2 rows/plot were harvested on September 13, and total and marketable (dia. >38 mm dia.) weights were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to In (x + 1) and percent defoliation was transformed to sqrt (arcsine (prop)) before analyses. The Retransformed means are presented.

RESULTS: By July 17, all products reduced the population levels of early instars of the CPB (Table 1). Although not always significant, NOVODOR at 7.1 L/ha was more efficacious than at 4.7 L/ha. No difference in efficacy was noted for the two formulations of lambda-cyhalothrin tested. Similar trends were noted for late instars of the CPB with respect to the efficacy of the two rates of NOVODOR and for the two formulations of lambda- cyhalothrin (Table 2). No statistical differences in the number of CPB adults/ 10 sweeps were noted early in the growing season (Table 3). All products significantly reduced the number of adults relative to the Check on July 31. All products protected potato foliage from feeding damage by the CPB (Table 4). Defoliation in the treated plots rose at the end of the experiment because adults dispersed from the defoliated Check into the less defoliated plots treated with NOVODOR, KRYOCIDE, WARRIOR, or THIODAN. Plots treated with either formulation of lambda-cyhalothrin or THIODAN tended to undergo less defoliation possibly because of a longer residual activity relative to NOVODOR or KRYOCIDE, Tuber yields, particularly marketable yields, were inversely correlated with the level of defoliation (Table 4). No phytotoxicity was observed for any of the products tested.

CONCLUSIONS: All products tested reduced population levels of early and late instars, and adults of the CPB. Marketable tuber yields from plots treated with either KARATE, WARRIOR, or THIODAN was significantly greater than for plots protected with NOVODOR or KRYOCIDE. However, acceptable tuber yields were recovered from plots treated with any product and these yields were significantly greater than the Check.

Table 1. A comparison of the efficacy of several insecticides against early instars (L1-L2) of the Colorado potato beetle (CPB) on potatoes at Harrington, P.E.I., 1995.*

Treatment	Rate (product/ha)	No. of sprays	Mean number of CPB early instars (L1-L2)/10 sweeps July				
			5	11	17	24	31
Check	---	0	23.0	36.8a	39.3a	37.0a	6.8abc
NOVODOR	4.7 L	6	24.0	31.5ab	16.5b	22.8b	8.8a
NOVODOR	7.1 L	6	42.3	34.8ab	11.5bc	12.Obc	7.Oab
KRYOCIDE	11.5 kg	4	44.8	25.5ab	8.0bc	2.0c	2.3bcd
KARATE	200 ml	4	38.8	10.Oab	3.5c	3.5c	1.3cd
WARRIOR	83.3 ml	4	43.8	21.8ab	2.5c	3.5c	1.5bcd
THIODAN	1.4 L	4	21.0	8.3b	1.0c	4.3c	0.0d
ANOVA P<0.05			ns	ns	---	---	---

* Figures are the means of 4 replications. Numbers within a column followed by the same letter are not significantly different according to a Least Squares Difference Test (P<0.05).

Table 2. A comparison of the efficacy of several insecticides against late instars (L3-L4) of the Colorado potato beetle (CPB) on potatoes at Harrington, P.E.I., 1995.*

Treatment	Rate (product/ha)	No. of sprays	Mean number of CPB late instars (L3-L4)/10 sweeps July				August
			11	17	24	31	8
Check	-	0	69.5a	75.Oa	80.5a	34.5a	2.Obc
NOVODOR	4.7 L	6	30.3abc	25.Ob	28.3b	27.8ab	6.8a
NOVODOR	7.1 L	6	46.0ab	25.3b	19.5bc	16.0bc	4.3ab
KRYOCIDE	11.5 kg	4	41.8abc	14.3bc	4.0c	3.3cd	1.5c
KARATE	200 ml	4	11.8bc	6.3bc	7.3bc	2.8d	2.Obc
MATADOR	83.3 ml	4	30.Oabc	6.8bc	4.8c	6.3cd	1.3c
THIODAN	1.4 L	4	4.0c	2.3c	6.0bc	1.0d	0.5c
ANOVA P<0.05			---	---	---	---	---

* Figures are the means of 4 replications. Numbers within a column followed by the same letter are not statistically different according to a Least Squares Difference Test (P<0.05).

Table 3. A comparison of the efficacy of several insecticides against adults of the Colorado potato beetle (CPB) on potatoes at Harrington, P.E.I., 1995.*

Treatment	Rate (product/ha)	No. of sprays	Mean number of CPB adults/10 sweeps July 5	July 11	July 17	July 31	August 8
Check	---	0	3.0	1.5	0.5b	49.Sa	65.8a
NOVODOR	4.7 L	6	4.0	0.5	0.Ob	2.8b	37.5ab
NOVODOR	7.1 L	6	1.8	1.3	0.3b	7.8b	33.8ab
KRYOCIDE	11.5 kg	4	2.8	4.0	1.5a	4.3b	51.0a
KARATE	200 ml	4	2.8	1.0	0.0b	2.0b	14.8b
WARRIOR	83.3 ml	4	0.5	2.3	0.3b	4.5b	18.8b
THIODAN	1.4 L	4	2.3	2.8	0.0b	1.8b	13.3b
ANOVA P<0.05			ns	ns	---	---	---

* Figures are the means of 4 replications. Numbers within a column followed by the same letter are not statistically different according to a Least Squares Difference Test (P<0.05).

Table 4. Defoliation (%) and tuber yields of potato plots protected with different insecticides for the management of the Colorado potato beetle, Harrington, P.E.I., 1995.*

Treatment	Rate (product/ha)	No. of sprays	Defoliation (%)** July 21	Defoliation (%)** August 4	Defoliation (%)** August 8	Tuber yields (t/ha) Total	Tuber yields (t/ha) Marketable
Check	---	0	16.1a	43.3a	96.5a	23.4d	19.9c
NOVODOR	4.7 L	6	4.5b	5.6b	40.3bc	30.2bc	27.4b
NOVODOR	7.1 L	6	4.5b	7.6b	41.8b	29.3c	26.7b
KRYOCIDE	11.5 kg	4	4.5b	7.6b	40.3bc	29.8c	26.8b
KARATE	200 ml	4	3.1c	3.8b	17.2d	33.2a	30.8a
WARRIOR	83.3 ml	4	3.0c	3.8b	26.1cd	32.3ab	29.9a
THIODAN	1.4 L	4	2.8c	3.0b	18.8d	33.2a	30.4a
ANOVA P<0.05			---	---	---	---	---

* Figures are the means of 4 replications. Numbers within a column followed by the same letter are not statistically different according to a Least Squares Difference Test (P<0.05).

** The data were transformed to the sqrt (arcsine (prop)) before analysis. Detransformed means are presented.

#053 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 309-1251-9322

CROP: Potato, cv. Red Pontiac

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: THE EFFECTS OF THREE CONCENTRATIONS OF SAFERS INSECTICIDAL SOAP ON THE COLORADO POTATO BEETLE

MATERIALS: SAFERS SOAP, potassium salts of fatty acids, 50.5%

METHODS: Colorado potato beetle larvae were reared on treated potato leaves. There were 4 treatments: potato leaves dipped in water, or 1%, 2%, or 4% SAFERS SOAP. The potato leaves were air-dried after dipping. Ten egg masses were collected from a laboratory colony of Colorado potato beetles. After hatching, 20 first instars were selected from each egg mass and placed in groups of 5 in 9 cm plastic Petri dishes lined with moist filter papers. Fifty larvae, 5 from each egg mass, were reared on each treatment until the third instar or death. In a second study, first and second instars, reared from field-collected eggs, and third and fourth instars, collected from the field, were dipped for less than 1 s in the same 4 treatments described above. Sample size was 100 for first and second instars, and 200 for third and fourth instars. After dipping, the larvae were placed in filter paper lined Petri dishes containing untreated potato leaves. The larvae were observed after 24 h and the number of dead larvae was recorded.

RESULTS: In the feeding experiments, mortality increased as the concentration of SAFERS SOAP increased (Table 1). In the dipping experiments, mortality increased as the concentration of SAFERS SOAP increased for all four larval stages (Table 2). However, the second instars were more susceptible than the other three instars.

CONCLUSION: At the recommended concentration of 2%, SAFERS SOAP was not very effective as either a contact or residual insecticide for controlling the Colorado potato beetle. It was more effective at 4%. As a contact insecticide, it worked best against second instars.

Table 1. Mean mortality (%) of Colorado potato beetle larvae fed on potato leaves dipped in 0%, 1%, 2% and 4% solutions of SAFERS SOAP.*

% Soap	Mortality	SEM**
0	6	3
1	12	3
2	26	4
4	70	10

* Each mean is based on a sample size of 50. First instars were placed on treated foliage. The insects were observed until the third instar or death, whichever came first.

** SEM: Standard error of the mean.

Table 2. Mean mortality (%) of first, second, third and fourth instars of the Colorado potato beetle dipped in 0%, 1%, 2% and 4% solutions of SAFERS SOAP.*

Instar	Treatment							
	Water		1% Soap		2% Soap		4% Soap	
	Mort.	SEM**	Mort.	SEM	Mort.	SEM	Mort.	SEM
First	1	1	6	2	12	4	17	4
Second	0	0	7	2	36	5	69	6
Third	1	1	7	2	14	3	26	4
Fourth	0	0	1	1	4	1	10	2

* Sample size was 100 for first and second instars, and 200 for third and fourth instars. Larvae were dipped in the appropriate solution for less than 1 second, then observed after 24 h for mortality.

** SEM: Standard error of the mean.

#054 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61006535

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

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TITLE: ADDITION OF INCITE 92% PBO WITH SYNTHETIC PYRETHROID INSECTICIDES FOR INSECT CONTROL IN POTATOES

MATERIALS: POUNCE 384EC (permethrin); INCITE 92% PBO (piperonyl butoxide); DECIS 5.0EC (deltamethrin); CYMBUSH 250EC (cypermethrin)

METHODS: Potatoes were planted in two-row plots, 7 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 8, 1995. The foliar applications were made using a back-pack air blast sprayer using 240 L/ha of spray mixture on June 14, 28, July 12 and 26. Assessments were taken by counting the number of CPB larvae per plot on June 21, 28, 30, July 5, 12, 26, by foliage damage ratings caused by CPB feeding damage on June 28, July 11 and 19, and by potato yields on August 3. Results were analysed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: As presented in the tables.

CONCLUSIONS: INCITE 95% PBO increased the level of CPB control when added with the synthetic pyrethroid insecticides tested. The synergistic effect was especially noted when PBO was used in combination with POUNCE 384EC, the least effective of the synthetic pyrethroids in the trial. This combination resulted in a significant increase in potato yields.

Table 1. Colorado potato beetle counts.

		Insect Counts/Plot					
	Rate	Larvae		Adults			
Treatment	product ml/ha	June 21	June 28	June 30	July 5	July 12	July 26
POUNCE 384 EC	275	28.0b*	351.3a	126.3ab	87.5a	14.3a	0.0c
POUNCE 384 EC + INCITE 92% PBO	275 580	0.3c	46.3b	1.5c	0.3c	0.5b	15.0b
POUNCE 348 EC + INCITE 92% PBO	550 1160	1.3c	16.0b	0.3c	2.3c	0.8b	14.5b
CYMBUSH 250 EC	140	3.0c	57.3b	9.8c	21.8bc	8.0ab	13.8b
CYMBUSH 250 EC + INCITE 29% PBO	140 580	0.0c	12.3b	3.5c	1.8c	7.3ab	27.5a
CYMBUSH 250 EC + INCITE 95% PBO	280 1160	0.0c	9.3b	0.5c	0.5c	0.8b	20.0ab
DECIS 5.0 EC	150	3.0c	33.8b	83.5bc	63.0ab	9.0ab	14.5b
DECIS 5.0 EC + INCITE 92% PBO	150 580	0.0c	1.3b	0.0c	0.5c	1.0b	20.0ab
DECIS 5.0 EC + INCITE 92% PBO	300 1160	0.0c	3.5b	0.0c	0.3c	0.5b	16.3b
Control		72.8a	420.0a	199.3a	75.0a	4.3ab	0.0c

* Means followed by the same letter do not differ significantly (P• 0.05, Duncan's Multiple Range Test).

Table 2. Foliage damage results.

		Foliar Damage Ratings (0-10)*			
	Rate	CPB	Yield(Kg/plot)		
Treatment	product ml/ha	June 28	July 11	July 19	Aug. 3
POUNCE 384 EC	275	4.0d**	2.5d	2.8e	3.4b
POUNCE 384 EC + INCITE 92% PBO	275 580	8.0c	7.3c	7.0c	6.9a
POUNCE 348 EC + INCITE 92% PBO	550 1160	9.5ab	9.0ab	9.0a	7.1a
CYMBUSH 250 EC	140	8.0c	7.3c	6.0d	6.7a
CYMBUSH 250 EC + INCITE 29% PBO	140 580	9.3ab	9.0ab	8.1b	7.4a
CYMBUSH 250 EC + INCITE 95% PBO	280 1160	10.0a	10.0a	9.0a	7.4a
DECIS 5.0 EC	150	8.8bc	7.0c	6.8c	6.7a
DECIS 5.0 EC + INCITE 92% PBO	150 580	10.0a	9.0ab	8.8a	7.0a
DECIS 5.0 EC + INCITE 92% PBO	300 1160	10.0a	8.8b	9.0a	7.1a
Control		3.0e	1.0e	1.0f	2.4b

* Foliar Damage Ratings (0-10) 0, no control, foliage severely damaged; 10, complete control.

** Means followed by the same letter do not differ significantly (P• 0.05, Duncan's Multiple Range Test).

#055 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61006535

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

NAME AND AGENCY:
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TITLE: APPLICATIONS OF ADMIRE 240F IN COMBINATION WITH OTHER INSECTICIDES FOR THE CONTROL OF POTATO INSECTS

MATERIALS: ADMIRE 240F (imidacloprid); GUTHION 96WP (azinphos-methyl); KRYOCIDE 96WP (cryolite: sodium aluminofluoride); WARRIOR 120EC (lambda-cyhalothrin); KARATE 50EC (lambda-cyhalothrin)

METHODS: Potatoes were planted in two-row plots, 7 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 5, 1995. The ADMIRE 240F treatments were applied as a 15 cm spray band (111.1 L/ha spray volume) in-furrow prior to planting. The foliar applications were applied using a back-pack air blast sprayer using 240 L/ha of spray mixture on June 15, 28, July 12 and 26. Due to the delay in receiving WARRIOR 120E, the June 15 application of this treatment was delayed until June 19, where KARATE 50EC was applied as a one time substitute, ie. KARATE 50EC sprayed once on June 19. The remaining three applications of WARRIOR 120E were applied with on the dates indicated. Assessments were taken by counting the number of CPB larvae and adults per plot on June 16, 21, 27, 30 and July 5, by foliage damage ratings caused by leafhopper and CPB feeding damage on June 28, July 12 and 19 and by potato yields on August 3. Results were analysed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: As presented in the tables.

CONCLUSIONS: The foliar application of GUTHION 240SC provided the most consistent potato insect control in this trial controlling both CPB and leafhoppers (Table 1). KRYOCIDE 96WP gave outstanding CPB control, (Table 1) but was ineffective in controlling leafhoppers (Table 2). WARRIOR 120EC was not available when the initial sprays were applied and was substituted 4 d later with KARATE 50EC. The level of CPB control was reduced due to both the delay in application and, possibly, a less efficacious material. WARRIOR 120EC and/or KARATE 50EC were effective in the control of potato leafhoppers. Half the lowest recommended rate of ADMIRE 240F was applied in-furrow providing control of CPB until just prior to June 27; approximately 54 d. Foliar applications of GUTHION 240SC and especially KRYOCIDE 96WP provided excellent CPB control. WARRIOR 240F could not reduce the high populations of CPB.

Table 1. Colorado potato beetle counts.

		Insect Counts/Plot					
	Rate	Larvae		Adults			
Treatments	Product	June 16	June 21	June 27	June 30	July 5	July 5
ADMIRE 240F*	4.17 ml/100m	0.5b**	63.5bc	592.5a	386.3a	406.3a	6.5bc
GUTHION 240SC	1.5 L/ha	0.0b	0.8c	12.0d	1.8c	7.5e	0.8c
KRYOCIDE 96WP	11.2 kg/ha	0.0b	0.0c	3.5d	0.5c	8.5e	1.0c
WARRIOR 120EC	83.0 ml/ha	16.3a	86.3b	267.5bc	34.3c	145.3cd	16.0ab
ADMIRE 240F + GUTHION 240SC	4.17 ml/100m 1.5 L/ha	0.0b	0.0c	27.0d	40.0c	100.0ed	1.8c
ADMIRE 240F + KRYOCIDE 96WP	4.17 ml/100m 11.2 kg/h	0.0b	0.0c	0.3d	0.5c	8.5e	6.3bc
ADMIRE 240F + WARRIOR 120EC	4.17 ml/100m 83.0 ml/ha	0.0b	8.5c	164.0c	205.3b	297.5ab	3.8c
Control		41.5a	287.5a	333.8b	335.0a	243.8bc	22.8a

* ADMIRE 240F was applied in-furrow at planting.

** Means followed by the same letter do not differ significantly (P• 0.05, Duncan's Multiple Range Test).

Table 2. Foliage damage results.

		Foliar Damage Ratings (0-10)*				Yield
	Rate	Leafhoppers	CPB			(Kg/plot)
Treatments	Product	July 12	June 28	July 12	July 19	Aug. 3
ADMIRE 240F**	4.17 ml/100 m	2.8c***	5.5c	2.3c	2.7c	11.3b
GUTHION 240SC	1.5 L/ha	8.5a	9.5ab	8.8a	9.0a	18.0a
KRYOCIDE 96WP	11.2 kg/ha	4.5b	10.0a	9.0a	9.0a	15.6ab
WARRIOR 120EC	83.0 ml/ha	8.5a	6.1c	6.3b	8.3a	12.3b
ADMIRE 240F + GUTHION 240SC	4.17 ml/100 m 1.5 L/ha	8.3a	9.3ab	8.0a	8.9a	15.8ab
ADMIRE 240F + KRYOCIDE 96WP	4.17 ml/100 m 11.2 kg/h	4.5b	9.8a	9.0a	9.0a	15.2ab
ADMIRE 240F + WARRIOR 120EC	4.17 ml/100 m 83.0 ml/ha	8.5a	8.5b	6.0b	6.0b	14.2ab
Control		1.8c	4.0d	2.5c	3.0c	10.1b

* Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.

** ADMIRE 240F was applied in-furrow at planting

*** Means followed by the same letter do not differ significantly (P• 0.05, Duncan's Multiple Range Test).

#056 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61006535

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

NAME AND AGENCY:
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TITLE: COMPARISON OF KARATE 50EC AND WARRIOR 120EC FOLIAR APPLICATIONS FOR INSECT CONTROL ON POTATOES

MATERIALS: KARATE 50EC (lambda-cyhalothrin); WARRIOR 120EC (lambda-cyhalothrin)

METHODS: Potatoes were planted in two-row plots, 7 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 8, 1995. The foliar applications were applied using a back-pack air blast sprayer using 240 L/ha of spray mixture. Treatment applications commenced on June 15 for Treatment 1, while, due to the unavailability of the candidate insecticide in Treatment 2 it was delayed until 4 d later (June 19). Consequent to the irregularity in the initial spray timings, the remaining treatments were both applied on June 28, July 12 and 26. Assessments were taken by counting the number of CPB larvae per plot on June 16, 21, 27 and 30, and adults on July 12 and 17, by foliage damage ratings caused by leafhopper and CPB feeding damage on June 28, July 12 and 19, and by potato yields on August 3. Results were analysed using the Duncan's Multiple Range Test(P• 0.05).

RESULTS: As presented in the tables.

CONCLUSIONS: KARATE 50EC and WARRIOR 120EC provided excellent control of leafhoppers and CPB larvae, but not CPB adults (Table 1). The effect of the early- season control of CPB larvae was higher potato yields. Due to the unavailability of the insecticide WARRIOR 120EC at the time when the initial spray was determined necessary (June 15), the 5 d delay in application resulted in a significant reduction in insect control and a loss in potato yields (Table 2). By June 30 the beneficial effect of WARRIOR 120EC was observed providing equal control of CPB larvae when compared with KARATE 50E. The second generation adults were not adequately controlled as noted by the counts on July 12 and 17. By this time the foliage of the control plots had been defoliated and with few insects observed.

Table 1. Colorado potato beetle counts.

		Insect Counts/Plot					
	Rate	Larvae		Adults			
Treatment	ml product/ha	June 16	June 21	June 27	June 30	July 12	July 17
KARATE 50EC	200.0	0.8b*	2.3b	171.3b	141.0b	186.3a	173.8a
WARRIOR 120EC	83.0	14.8a	41.3b	328.8b	66.3b	173.8a	177.5a
Control		9.0ab	406.3.a	883.8a	532.5a	26.3b	2.5b

* Means followed by the same letter do not differ significantly (P• 0.05, Duncan's Multiple Range Test).

Table 2. Foliage damage results.

		Foliar Damage Ratings (0-10)*			Yield
		Leafhoppers	CPB		(Kg/plot)
Treatment	ml product/ha	July 12	June 28	July 19	Aug. 3
KARATE 50EC	200.0	10.0a**	7.8a	5.3a	12.5a
WARRIOR 120EC	83.0	10.0a	7.5a	4.8a	10.8b
Control		1.0b	2.8b	1.0b	5.7c

* Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.

** Means followed by the same letter do not differ significantly (P• 0.05, Duncan's Multiple Range Test).

#057 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61006535

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

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TITLE: EVALUATION OF *Bt* INSECTICIDES FOR THE CONTROL OF CPB IN POTATOES

MATERIALS: M-TRAK (*Bacillus thuringiensis* var. *tenebrionis*);
NOVODOR (*Bacillus thuringiensis* var. *tenebrionis*)

METHODS: Potatoes were planted in two-row plots, 7 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed pieces were planted with a commercial planter on May 8, 1995. The foliar applications were applied using a back-pack air blast sprayer using 240 L/ha of spray mixture on June 15, 28 and July 12. Due to the delay in receiving NOVODOR, the June 15 application of this treatment was delayed 4 d and was applied on June 19. Assessments were taken by counting the number of CPB larvae and adults per plot on June 16, 21, 27, 30, July 5 and 18, by foliage damage ratings caused by leafhopper and CPB feeding damage on June 28, July 12 and 19, and by potato yields on August 3. Results were analysed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: As presented in the table.

CONCLUSIONS: M-TRAK and NOVODOR provided moderate levels of CPB larval control (Table 1), however, were ineffective in controlling CPB adults (Table 1) or potato leafhoppers (Table 2). The initial spray of NOVODOR was delayed 4 d compared to M-TRAK resulting in higher early CPB larval counts. After NOVODOR was applied it provided larval control that was as good as M-TRAK. The high larval counts on June 27 could be explained by the longer spray interval between the two Bt products. After populations of CPB larvae become large, insect control become more difficult with either of these two products. The lower CPB insect counts later in the season reflects a high level of defoliation.

Table 1. Colorado potato beetle counts.

		Insect Counts/plot					
	Rate	Larvae			Adults		
Treatment	Product L/ha	June 16	June 21	June 27	June 30	July 5	July 18
M-TRAK	8.0	2.5b*	0.8b	207.5b	152.2ab	263.8a	85.0a
NOVODOR	8.0	24.3a	22.3b	18.0c	96.3b	191.3a	1.3ab
Control		26.8a	227.5a	702.5a	216.0a	54.3a	10.8b

* Means followed by the same letter do not differ significantly (P• 0.05, Duncan's Multiple Range Test).

Table 2. Foliage damage results.

		Foliar Damage Ratings (0-10)*				
						Yield
	Rate	Leafhoppers	CPB			Kg/plot
Treatment	Product L/ha	July 12	June 28	July 12	July 19	Aug. 3
M-TRAK	8.0	2.0a**	8.9a	3.5a	3.0a	6.3a
NOVODOR	8.0	2.0a	9.0a	3.5a	3.0a	6.1a
Control		1.0b	2.0b	1.0b	1.0b	3.1b

* Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.

** Means followed by the same letter do not differ significantly (P• 0.05, Duncan's Multiple Range Test).

#058 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61006535

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

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TITLE: INSECT CONTROL IN POTATOES USING EXP-60707A

MATERIALS: EXP-60707A (experimental); ADMIRE 240F (imidacloprid)

METHODS: Potatoes were planted in two-row plots, 7 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 8, 1995. The foliar applications were applied using a back-pack air blast sprayer using 240 L/ha of spray mixture. Treatments commenced on June 15 for Treatment 3, while, due to the unavailability of EXP-60707A 20SP, it was delayed until June 28. Further applications were made using both products every 14 d on July 12 and 26. Assessments were taken by counting the number of CPB larvae and adults per plot on June 21, 27, 30, July 5, 12 and 26, by foliage damage ratings caused by leafhoppers and CPB feeding damage on June 28, July 12 and 19, and by potato yields on August 3. Results were analysed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: As presented in the tables.

CONCLUSIONS: Significant insect damage resulted in delaying the application of EXP-60707A 20SP 13 d after the action threshold of 2 beetles per plant was exceeded on June 15 (Table 1). This resulted in severe defoliation during the later two weeks of June. After EXP-60707A 20SP was applied excellent control of CPB larval was achieved especially for the higher rate on June 30. EXP-60707A 20SP provided moderate leafhopper control. However, these ratings were made more difficult due to the severe attack by the CPB.

ADMIRE 240F gave outstanding control of CPB larvae and adults resulting in the highest potato yields (Table 2). The interval of control of CPB larva using ADMIRE 240F as a foliar application was approximately 20 d in this experiment. ADMIRE 240F was initially applied on June 15 with the second application on July 12. It was only on the July 5th evaluation that larval populations began to build up, 20 d after application.

Table 1. Colorado potato beetle counts.

		Insect Counts/Plot					
		Larvae		Adults			
Treatment	Product/ha	June 21	June 27	June 30	July 5	July 12	July 26
EXP-60707A 20SP	125 g	96.3a*	868.8a	69.8b	10.8b	187.0a	88.8a
EXP-60707A 20SP	250 g	78.8a	846.3a	3.0c	2.8b	113.8ab	63.8a
ADMIRE 240F	208 ml	0.0b	1.3b	2.0c	34.0b	91.3ab	52.5a
Control		75.5a	876.3a	602.0a	371.3a	47.3b	0.0b

* Means followed by the same letter do not differ significantly (P• 0.05, Duncan's Multiple Range Test).

Table 2. Foliage damage results

		Foliar Damage Ratings (0-10)*				Yield
	Rate	Leafhoppers	CPB			Kg/plot
Treatments	Product/ha	July 12	June 28	July 12	July 19	Aug. 3
EXP-60707A 20SP	125 g	6.0b**	4.5b	5.5b	6.8b	11.6b
EXP-60707A 20SP	250 g	6.0b	4.3b	6.0b	7.3b	13.2b
ADMIRE 240F	208 ml	7.8a	10.0a	8.8a	9.4a	16.2a
Control		1.0c	4.3b	1.3c	1.3c	8.3c

* Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.

** Means followed by the same letter do not differ significantly (P• 0.05, Duncan's Multiple Range Test).

#059 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61006535

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

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TITLE: POTATO INSECT CONTROL USING ADMIRE 240F

MATERIALS: ADMIRE 240F (imidacloprid)

METHODS: Potatoes were planted in two-row plots, 7 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. ADMIRE 240F was applied in-furrow just prior to planting in a narrow band, 2 cm, or in a wider band 10-15 cm using either 11.1 or 111.1 L/ha of spray volume. Potato seed pieces were planted with a commercial planter on May 8, 1995. The foliar applications were applied using a back-pack air blast sprayer using 240 L/ha of spray mixture on June 14. Assessments were taken by counting the number of CPB larvae per plot on June 21, 27, July 4 and 12, by foliage damage ratings caused by leafhopper and CPB feeding damage on June 28, July 12, and by potato yields on August 3. Results were analysed using the Duncan's Multiple Range Test(P• 0.05).

RESULTS: As presented in the tables.

CONCLUSIONS: The recommended rates of ADMIRE 240F of 8.33 and 12.5 ml product/100m of row, provided outstanding control of CPB and commercial control of potato leafhoppers. Potato leafhoppers moved into the plots around July 1. Altering the water rates or the width of the spray did not significantly alter the level of potato insect control. Besides the check, numerically the lowest yields were when ADMIRE 240F was applied at the lower foliar rate and the lowest in-furrow rate using the lowest amounts of water.

Table 1. Colorado potato beetle counts.

Treatment	Rate product	In-Furrow Band Width (cm)	Water Rate L/ha	CPB Larval Counts/plot June 21	June 27	July 4	July 12
ADMIRE 240F	4.17 ml/100 m	15	11.1	6 b*	256 b	333 a	224 a
ADMIRE 240F	8.33 ml/100 m	15	11.1	3 b	100 cd	170 bc	166 abc
ADMIRE 240F	12.5 ml/100 m	15	11.1	0 b	34 d	109 bcd	84 bc
ADMIRE 240F	4.17 ml/100 m	15	111.1	10b	196 bc	180 b	100 bc
ADMIRE 240F	8.33 ml/100 m	15	111.1	0 b	73 cd	139 bcd	185 ab
ADMIRE 240F	12.5 ml/100 m	15	111.1	0 b	38 d	136 bcd	106 bc
ADMIRE 240F	4.17 ml/100 m	2	11.1	9 b	145 bcd	189 b	132 ab
ADMIRE 240F	8.33 ml/100 m	2	11.1	1 b	19 d	114 bcd	124 abc
ADMIRE 240F	12.5 ml/100 m	2	11.1	3 b	84 cd	146 bcd	99 bc
ADMIRE 240F	4.17 ml/100 m	2	111.1	1 b	150 bcd	208 b	85 bc
ADMIRE 240F	8.33 ml/100 m	2	111.1	0 b	23 d	90 bcd	74 bc
ADMIRE 240F	12.5 ml/100 m	2	111.1	0 b	13 d	65 bcd	89 bc
ADMIRE 240F	104.2 ml/ha	Foliar		0 b	2 d	29 cd	63 c
ADMIRE 240F	208.3 ml/ha	Foliar		0 b	0 d	17 d	86 bc
Control				200 a	404 a	198 b	67 c

* Means followed by the same letter do not differ significantly (P= 0.05, Duncan's Multiple Range Test).

Table 2. Foliage damage results.

				Foliar Damage Ratings (0-10)*			
		In Furrow	Water	Leaf-			Yield
	Rate	Band Width	Rate	hoppers	CPB		(Kg/plot)
Treatment	product	(cm)	L/ha	July 12	June 23	July 12	Aug. 3
ADMIRE 240F	4.17 ml/100m	15	11.1	5 b**	7 f	4 d	15 cd
ADMIRE 240F	8.33 ml/100m	15	11.1	7 a	9 b-e	6 c	17 a-d
ADMIRE 240F	12.5 ml/100m	15	11.1	8 a	9 a-d	9 a	20 abc
ADMIRE 240F	4.17 ml/100m	15	111.1	5 b	8 ef	6 cd	19 abc
ADMIRE 240F	8.33 ml/100m	15	111.1	4 b	8 def	6 c	21 ab
ADMIRE 240F	12.5 ml/100m	15	111.1	7 a	9 ab	7 bc	19 abc
ADMIRE 240F	4.17 ml/100m	2	11.1	5 b	8 ef	5 d	15 cd
ADMIRE 240F	8.33 ml/100m	2	11.1	8 a	10 a	8 ab	22 a
ADMIRE 240F	12.5 ml/100m	2	11.1	8 a	9 abc	8 ab	19 abc
ADMIRE 240F	4.17 ml/100m	2	111.1	7 a	8 cde	8 ab	17 a-d
ADMIRE 240F	8.33 ml/100m	2	111.1	8 a	10 a	9 a	20 abc
ADMIRE 240F	12.5 ml/100m	2	111.1	8 a	10 a	9 ab	21 abc
ADMIRE 240F	104.2 ml/ha	Foliar		8 a	10 a	9 ab	16 bcd
ADMIRE 240F	208.3 ml/ha	Foliar		8 a	10 a	8 ab	17 a-d
Control				2 c	5 g	3 e	12 d

* Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.

** Means followed by the same letter do not differ significantly (P• 0.05, Duncan's Multiple Range Test).

#060 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61006535

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

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TITLE: REDUCED RATES OF INSECTICIDES FOR THE CONTROL OF COLORADO POTATO BEETLE (CPB) ON POTATOES

MATERIALS: AMBUSH 500EC (permethrin); SEAWEED and FISH LIQUID EXTRACT

METHODS: Potatoes were planted in single row plots 7 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 8, 1995. The foliar applications were applied using a back-pack air blast sprayer using 240 L/ha of spray mixture on June 15 and 28. Assessments were taken by counting the number of CPB larvae per plot on June 14, 16, 21, 28 and 30. Results were analysed using the Duncan's Multiple Range Test (P• 0.05).

RESULTS: As presented in the tables.

CONCLUSIONS: The level of CPB populations were extremely high. The insecticide AMBUSH 500E at a commercially reduced rate was ineffective in controlling CPB numbers except on June 21. The addition of seaweed and fish liquid extract did not provide any additional level of insect control.

Table 1. Colorado potato beetle counts.

		Insect Counts/plot					
	Rate	Larvae					Adult
Treatment	Product/ha	June 14	June 16	June 21	June 28	June 30	June 16
AMBUSH 500EC	75.0 ml	9.0a*	4.3a	186.3b	455.0a	110.3a	1.8a
SEAWEED + FISH EXTRACT	1.1 L 2.5 L	1.8a	8.0a	360.0a	430.0a	45.5a	3.8a
AMBUSH 500EC + SEAWEED + FISH EXTRACT	75.0 ml 1.1 L 2.5 L	0.0a	3.0a	142.5b	570.0a	149.8a	3.0a
Control		0.0a	13.0a	486.3a	295.0a	39.8a	5.8a

* Means followed by the same letter do not differ significantly (P• 0.05, Duncan's Multiple Range Test).

#061 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100104

CROP: Potato, cv. Kennebec

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: EFFECTS OF VARIOUS RATES AND COMBINATIONS OF INSECTICIDES ON THE CONTROL OF COLORADO POTATO BEETLE (CPB), 1995

MATERIALS: AC 303,630; RIPCORD (cypermethrin);
SPINOSAD NAF 127 (*Saccharopolyspora spinosa* 80WG);
SPINOSAD NAF 144 (*Saccharopolyspora spinosa* 1.6% broth); KARATE 50EC and 120EC (fenpropathrin); ADMIRE 240FS (imidacloprid); M-TRAK (*Bacillus thuringiensis* var. *san diego*)

METHODS: Potatoes were planted at the Cambridge Research Station on May 8, in four-row plots, 15 m long, replicated four times. Rows were spaced 0.9 m apart and plots were separated by 3 m fallow spray lanes. Treatments were arranged in a randomized complete block design.

Insecticides were applied with a tractor-mounted, four-row boom sprayer that delivered 800 L/ha at 450 kPa. Two hundred CPB egg masses were tagged on June 13 and checked daily to determine hatch. Egg hatch was 16% by June 15 and 33% by June 16. All products were applied on June 16, with subsequent sprays against the first generation of CPB on June 23 and 29. The surfactant AGRAL was used with all treatments of AC 303,630 and RIPCORD.

Populations of CPB were monitored 3 d after the initial spray and weekly thereafter. Counts were taken by examining the numbers of larvae and adults on 5 plants in each plot. The percent defoliation caused by adults and larvae was estimated. Tubers were harvested on August 28, 29 and 30.

RESULTS: As presented in table.

CONCLUSIONS: All treatments except the low rate of SPINOSAD NAF 144 and RIPCORD controlled CPB after the first spray and remained effective for two weeks following the final spray (Table 1). SPINOSAD NAF 144 at 12.5 g ai/ha and RIPCORD at 35.0 g ai/ha gave one week of control. All treatments resulted in significantly higher yields than the unsprayed check.

Table 1. Number of CPB large larvae per plant, percent defoliation and yield, 1995.

Insecticide**	Rate (g ai/ha)	Large larvae* June 30	Large larvae* July 6	Large larvae* July 13	Percent defoliation* June 30	Percent defoliation* July 6	Percent defoliation* July 13	Yield* (t/ha)
AC 303,630	50	2.3b	3.5b	1.2c	8.1bcd	10.2cd	10.1cd	27.5bcdefg
AC 303,630 + RIPCORD	50 17	0.7b	5.1b	0.5c	4.5cd	24.8b	3.8ef	30.9abcd
AC 303,630 + RIPCORD	50 35	0.8b	2.1b	0.1c	5.5cd	3.3cde	2.9ef	32.1abc
RIPCORD	35	9.0b	8.6b	6.3ab	8.8bcd	10.8c	17.3b	29.5abcdef
SPINOSAD NAF 127	12.5	0.7b	1.4b	2.6bc	4.6cd	5.1cde	6.7cde	24.5efgh
SPINOSAD NAF 127	25.0	0.0b	0.2b	0.8c	5.0cd	4.4cde	4.5def	24.8defgh
SPINOSAD NAF 127	50.0	0.0b	0.0b	0.2c	3.7cd	2.2dc	4.3def	28.7abcdef
SPINOSAD NAF 127	75.0	0.0b	0.4b	0.0c	3.6cd	2.4cde	0.8f	26.1cdefgh
SPINOSAD NAF 144	12.5	7.2b	8.3b	8.3a	13.8b	9.0cde	17.5b	19.7h
SPINOSAD NAF 144	25.0	1.5b	3.5b	3.2bc	10.6bc	7.8cde	11.8bc	21.5gh
SPINOSAD NAF 144	50.0	2.5b	0.2b	0.9c	5.6cd	3.2cde	4.7def	22.7fgh
SPINOSAD NAF 144	75.0	0.5b	0.1b	0.8c	4.4cd	3.6cde	4.3def	23.0fgh
KARATE 50EC	10	1.3b	2.3b	1.9bc	5.0cd	5.0cde	7.2cde	33.7ab
KARATE 120EC	10	0.9b	3.4b	0.4c	6.4bcd	6.0cde	6.9cde	32.7abc
ADMIRE	50	0.0b	0.0b	0.0c	2.8d	1.2e	1.7ef	35.4a
M-TRAK	5.0L prod/ha	0.1b	0.4b	0.9c	2.0d	3.1cde	4.1ef	31.7abcd
Unsprayed check	1st gen.	53.2a	19.0a	8.3a	46.8a	60.8a	84.5a	4.1i
ANOVA (P• 0.05)		---	---	---	---	---	---	---

* Means in each column followed by the same letter are not significantly different at P• 0.05 (Tukey's Studentized Range Test).

** Insecticides were applied on June 16, 23 and 29.

#062 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100104

CROP: Potato, cv. Kennebec

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
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TITLE: EFFECTS OF VARIOUS RATES OF ADMIRE IN-FURROW TREATMENTS ON THE CONTROL OF COLORADO POTATO BEETLE (CPB), 1995

MATERIALS: ADMIRE (imidacloprid), DECIS (deltamethrin); NOVODOR (*Bacillus thuringiensis* var. *tenebrionis*)

METHODS: At the Cambridge Research Station, potatoes were planted on May 8, 1995, in four-row plots that were 15 m long. Rows were spaced 0.9 m apart and plots were separated by 3 m fallow spray lanes. Treatments were arranged in a randomized complete block design with four replications. In-furrow applications were made using a backpack sprayer equipped with a flat fan nozzle. Tubers were sprayed in the open furrows with the respective concentration of ADMIRE. The plots were hilled immediately after the in-furrow application. Foliar insecticides were applied with a tractor-mounted, four-row boom sprayer that delivered 800 L/ha at 450 kPa. The foliar program was initiated on June 16 using DECIS to control CPB adults and to reduce egg laying. Subsequent sprays, using NOVODOR to control CPB larvae, were applied June 23 and June 29.

Populations of CPB were monitored 4 d after the initial spray and then weekly until the end of the first generation in mid July. Counts were taken by examining 5 plants in each plot, and the numbers of larvae and adults were recorded. The percent defoliation caused by adults and larvae was estimated visually. Tubers were harvested September 6, 1995.

RESULTS: As presented in table.

CONCLUSIONS: All treatments significantly reduced the number of small and large larvae, and the amount of defoliation caused by feeding of CPB larvae. These reductions resulted in yields that were greater in all treated plots relative to the unsprayed check.

Table 1. Mean* number of small larvae (SL), large larvae (LL), percent defoliation (DEF), and yield on potato, cv. Kennebec, 1995.

		June 28	July 4	July 11	June 28	July 4	July 11	Yield
Treatment	prod/100 M	SL	LL	LL	DEF	DEF	DEF	t/ha
ADMIRE 240FS	6.3 ml	0.0b	0.1b	0.2b	0.3b	0.6b	0.8c	27.2b
ADMIRE 240FS	8.3 ml	0.0b	0.1b	0.0b	0.5b	0.2b	0.7c	35.6ab
ADMIRE 240FS	12.5 ml	0.0b	0.0b	0.0b	0.2b	0.4b	0.7c	37.2a
DECIS	150 ml	9.3b	0.6b	1.3b	4.2b	2.7b	5.5b	37.3a
NOVODOR	5.0 L/ha							
Unsprayed check	----	32.0a	20.0a	6.6a	56.8a	85.9a	95.8a	1.4c
ANOVA (P• 0.05)		---	---	---	---	---	---	---

* Means in each column followed by the same letter are not significantly different at P• 0.05 (Tukey's Studentized Range Test).

#063 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1251-8702

CROP: Potato, cv. Green Mountain

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
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TITLE: EVALUATION OF INSECTICIDES TANK-MIXED WITH FUNGICIDES FOR COLORADO POTATO BEETLE CONTROL ON POTATOES, 1995

MATERIALS: TRIGARD 75 WP (cyromazine); RIPCORD 400 EC (cypermethrin); RIDOMIL MZ 72 WP (metalaxyl + mancozeb); BRAVO 500 F (chlorothalonil)

METHODS: Cut seed pieces were planted in Harrington, P.E.I., on May 23, 1995. Plants were spaced at about 40 cm within rows and about 90 cm between rows in four-row plots. Plots measuring 7.6 m in length and 3.6 m in width, were separated from each other by 1.8 m of cultivated soil. Plots were arranged in a randomized complete block design with eight treatments each replicated four times. All treatments were applied as a spray mixture equivalent to 303 L/ha at a pressure of about 240 kPa using a CO_2-pressurized plot sprayer. First sprays on July 5 were timed to coincide with about 10% - 30% egg hatch of the CPB egg masses. No fungicides were applied on July 5. Subsequent sprays were applied when a threshold of 1 CPB per net sweep was reached or surpassed. Additional sprays were applied to all treated plots on July 12, July 20, July 27, August 10 and August 17. On August 3 all treatments were sprayed except for the TRIGARD + RIDOMIL and the TRIGARD + BRAVO. All plots were treated with oxamyl at the rate of 700 g a.i./ha on August 22 and August 29 to control summer adults. Each week from July 5 to August 21, the numbers of early instars (1st and 2nd), late instars (3rd and 4th), and adults per 10 net sweeps (0.37 m diameter) were counted from the centre two rows of each plot. Weeds were controlled with an application of metribuzin at 750 g a.i./ha on May 27. Plants were sprayed with diquat at 370 g a.i./ha for top desiccation on September 20. Tubers from the centre two rows of each plot were harvested on October 4, and total and marketable ($\geq$38 mm) yields were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to ln (x+1) before analysis. Percent defoliation was transformed to sqrt (arsine (prop)) before analysis. The detransformed means are presented.

RESULTS: As presented in the tables.

CONCLUSIONS: The addition of RIDOMIL did not significantly affect the efficacy of either TRIGARD or RIPCORD but BRAVO negatively affected the efficacy of RIPCORD (Tables 1, 2, 3). The percent defoliation was lower in plots treated with RIPCORD + RIDOMIL than was RIPCORD + BRAVO by August 3. Similarly, defoliation ratings for RIPCORD were lower than those for TRIGARD by August 10. (Table 4). Marketable tuber yields were lower with RIPCORD + BRAVO than with RIPCORD alone or RIPCORD + RIDOMIL. The addition of RIDOMIL or BRAVO to TRIGARD was neither beneficial nor detrimental with respect to yield (Table 4). All insecticide treatments significantly improved yields over the check. No phytotoxicity was observed on plants in any of the plots.

Table 1. Response of Colorado potato beetle early instars to insecticides and fungicides, Harrington, P.E.I., 1995.

			Early Instars/10 Sweeps				
	g	No. of	July			August	
Treatment	a.i./ha	sprays	11	18	25	1	8
Check	---	---	56.8a*	50.3ab	26.5ab	12.8ab	2.3bc
TRI**	280	7	42.3ab	28.8bc	9.3bcd	2.5b	0.8cd
TRI + RID	280+1800	6	21.0bcd	28.3abc	6.5de	2.5b	0.0d
TRI + BRA	280+1200	6	25.0abc	26.8bc	7.5cd	3.5b	0.0d
RIP + RID	35+1800	7	8.0d	9.5d	4.0de	3.0b	0.3d
RIP + BRA	35+1200	7	8.3d	24.0c	18.5abc	35.3a	8.0a
RIP	35	7	12.0cd	8.0d	1.75e	3.5b	0.5d
BRA	1200	7	47.5ab	63.3a	40.8a	12.0b	4.0ab
ANOVA P<0.05			---	---	---	---	---

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test ($P<0.05$).

** TRI: TRIGARD; RID: RIDOMIL; RIP: RIPCORD; BRA: BRAVO.

Table 2. Response of Colorado potato beetle late instars to insecticides and fungicides, Harrington, P.E.I., 1995.

			Late Instars/10 Sweeps				
	g	No. of	July			August	
Treatment	a.i./ha	sprays	11	18	25	1	8
Check	-	-	74.5a*	115.5a	133.8a	33.3a	22.8ab
TRI**	280	7	7.3bc	24.3b	27.8bc	6.0b	0.5d
TRI + RID	280+1800	6	4.0c	9.5c	7.0d	3.0b	0.5d
TRI + BRA	280+1200	6	3.5c	10.5c	10.5cd	3.5b	1.0cd
RIP + RID	35+1800	7	6.3bc	11.8c	16.3bcd	5.5b	2.0cd
RIP + BRA	35+1200	7	11.0b	35.5b	32.3b	39.3a	48.5a
RIPCORD	35	7	5.5bc	10.3c	8.3d	4.3b	2.5c
BRA	1200	7	107.8a	125.5a	157.5a	36.5a	15.5b
ANOVA P<0.05			---	---	---	---	---

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test ($P<0.05$).

** TRI: TRIGARD; RID: RIDOMIL; RIP: RIPCORD; BRA: BRAVO.

Table 3. Response of Colorado potato beetle adults to insecticides and fungicides, Harrington, P.E.I., 1995.

			Adults/10 Sweeps				
	g	No. of	July			August	
Treatment	a.i./ha	sprays	11	18	25	1	8
Check	---	---	0.0e*	0.5cd	0.0	37.8a	171.0a
TRI**	280	7	3.3ab	2.8ab	0.8	2.5b	35.3bc
TRI + RID	280+1800	6	1.8cd	2.5bc	1.5	2.3b	27.3bc
TRI + BRA	280+1200	6	3.3bc	2.0ab	0.5	2.0b	13.0bcd
RIP + RID	35+1800	7	2.5bc	3.8ab	3.0	3.3b	10.8cd
RIP + BRA	35+1200	7	6.5a	5.0a	2.0	2.3b	36.3b
RIP	35	7	1.8bc	1.5bc	2.0	2.8b	8.3d
BRA	1200	7	0.5de	0.0d	0.0	49.3a	100.3a
ANOVA P<0.05			---	---	ns	---	---

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P<0.05).

** TRI: TRIGARD; RID: RIDOMIL; RIP: RIPCORD; BRA: BRAVO.

Table 4. Defoliation ratings and tuber yields for plots treated with insecticides and fungicides, Harrington, P.E.I., 1995.

		Percent Defoliation					Tuber yield (kg/ha)	
	g	July			August			Market
Treatment	a.i./ha	14	20	27	3	10	Total	-able
Check	---	7.6ab*	17.0b	32.9b	40.3a	69.8a	17.5c	11.5c
TRI	280	3.3bc	7.6c	4.5c	6.8bc	16.1bc	26.8b	21.1b
TRI + RID	280+1800	2.6c	4.5cd	4.5c	4.5c	9.9cd	29.6b	24.0b
TRI + BRA	280+1200	2.6c	4.5cd	4.5c	4.5c	5.3de	31.4b	25.8b
RIP + RID	35+1800	2.0c	3.9cd	3.8c	4.5c	4.5de	37.1a	32.2a
RIP + BRA	35+1200	2.0c	4.5cd	4.5c	11.3b	20.5b	30.2b	25.1b
RIP	35	2.0c	2.6d	3.0c	4.5c	2.5e	38.0a	33.2a
BRA	1200	10.8a	32.0a	41.5a	49.8a	79.3a	15.0c	9.5c
ANOVA P<0.05			---	---	---	---	---	

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P<0.05).

** TRI: TRIGARD; RID: RIDOMIL; RIP: RIPCORD; BRA: BRAVO.

#064 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 280-1252-9304

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
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TITLE: PERSISTENCE OF FOLIAR APPLICATION OF ADMIRE 240 F ON POTATO LEAVES

MATERIALS: ADMIRE 240 F (imidacloprid)

METHODS: Chitted seed potatoes were planted in London on 10 May in single-row micro plots (2.25 m long x 0.9 m wide) filled with insecticide residue-free organic soil. Both treatments were replicated three times in a randomized complete block design. ADMIRE was applied on 12 and 26 June at 250 kPa in 900 L water/ha using a single-nozzle (D-4 orifice disc, number 25 swirl plate) Oxford precision sprayer. To ensure leaves sampled for bioassay were actually exposed to ADMIRE, 25 fully developed compound leaves were tagged in each microplot prior to each application. Immediately after application, and thereafter at regular intervals (Table 1), 3 tagged leaves were harvested from separate plants in each microplot (9 leaves/tmt.), pooled together and returned to the laboratory for bioassay. A total of 5 bioassays, each containing 1 leaf and 5 adult insecticide-susceptible CPB adults, was established for each treatment. Bioassays were held at 25•C, 55% RH, and 16:8 L:D photoperiod. Mortality and leaf damage were recorded after 24, 48, and 72 h. During Expt. 1, plots received 10 mm water as overhead irrigation on the 2 and 4 d; during Expt. 2 plots received 27 mm rainfall on day 1. To measure potential residues of imidacloprid following foliar application over muck soils, at harvest on 21 August, 56 d after final application of ADMIRE, 5 random soil samples (15 samples/tmt.) were collected from all micro plots. Plots had been thoroughly tilled during potato harvest. Residues of imidacloprid were determined using HPLC by the Analytical Chemistry Services Group in the London laboratory of the Pest Management Research Centre.

RESULTS: As presented in the table. For the sake of brevity, percent reductions in damage to leaves by adults feeding for 72 h are the only bioassay data shown.

CONCLUSIONS: During both experiments, foliar residues of imidacloprid provided excellent protection of potato leaves for 3 d following application. Thereafter protection appeared to decline more rapidly in Expt. 2, perhaps due to heavy rainfall within 24 h after application.

RESIDUES: Low levels of imidacloprid (0.07 ppm) were detected in the pooled soil sample.

Table 1. Persistence of protection of potato leaves following foliar application of ADMIRE 240F.

Expt. 1: (12 June)

Treatment	Rate	% Damage Reduction on Indicated Day*						
Applied	Applied (ml/ha)	Day 0	Day 1	Day 2	Day 3	Day 7	Day 10	Day 14
ADMIRE 240F	200.0	97.2	96.5	92.6	94.3	40.9	46.1	15.3
CONTROL**	---	9.4	9.3	9.5	7.5	8.5	8.0	8.5

Expt. 2: (26 June)

Treatment	Rate	% Damage Reduction on Indicated Day*					
Applied	Applied (ml/ha)	Day 0	Day 1	Day 2	Day 3	Day 8	Day 10
ADMIRE 240F	200.0	94.6	91.4	93.5	86.5	32.0	3.4
CONTROL	---	8.5	7.6	9.0	9.5	9.9	7.7

* Relative to feeding damage in leaves from CONTROL plots.

** Actual 72 h Damage Rating (0-10 scale where 0 represents no feeding damage, 5 represents 50% loss of leaf area, 10 represents 100% consumption of the leaf).

#065 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 280-1252-9304

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
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TITLE: EFFECT OF SOIL TYPE ON CONTROL OF COLORADO POTATO BEETLE BY IN-FURROW APPLICATION OF ADMIRE 240 F

MATERIALS: ADMIRE 240 F (imidacloprid)

METHODS: Chitted seed potatoes were planted in London on 10 May in single-row micro plots (2.25 m long x 0.9 m wide) filled with insecticide residue-free mineral (Tmt. 1, 3) or organic soil (Tmt. 2) (Table 1). All treatments were replicated three times in a randomized complete block design. Furrow sprays were applied at 135 kPa in 5 L water/100 m row, in a 5-7 cm band over seed pieces in the bottom of the planting furrow, using a single-nozzle (6504 flat fan) Oxford precision sprayer. On 29 May, 3 compound leaves were harvested from separate plants in each microplot (9 leaves/tmt.) and returned to the laboratory for bioassay. A total of 5 bioassays, each containing 1 leaf and 5 adult insecticide-susceptible CPB adults, was established for each treatment. Bioassays were held at 25•C, 55% RH, and 16:8 L:D photoperiod. Mortality and leaf damage were recorded after 24, 48 and 72 h. Leaves were thereafter collected from all treatments at regular intervals for further bioassay (Table 1). Potatoes were harvested on 21 August. Tubers were graded, counted and weighed and marketable (Canada Number 1) yields were calculated. Significance of differences among marketable yields was determined by ANOVA (P• 0.05). On 31 May (Day 21), to measure imidacloprid in soil soon after planting, 5 in-row soil samples were collected from all micro plots (15 samples/tmt). To compare imidacloprid residues in developing plants, leaf samples were collected from all treatments on 05 June (Day 26). Samples of potatoes were collected at harvest on 20 August, for analysis of possible imidacloprid residues. On 21 August, 103 d after application of ADMIRE, 5 soil samples were collected at random from all plots of all treatments (15 samples/tmt.). All residues of imidacloprid were determined using HPLC by the Analytical Chemistry Services Group in the London laboratory of the Pest Management Research Centre.

RESULTS: As presented in the table. For the sake of brevity, percent reductions in damage to leaves by adults feeding for 72 h are the only bioassay data shown.

CONCLUSIONS: Imidacloprid applied in the seed furrow at planting was more readily taken up from loam than from muck soil by growing potatoes. In bioassays, leaves harvested up to 47 d after treatment, from plants growing in muck soils suffered at least twice as much damage as leaves harvested at the same times from potatoes growing in loam soil. A heavy 27 mm rainfall on day 48 is felt to be the cause of increased leaf protection observed on day 55 in muck soil and on day 61 in loam. Although potato vines in both soils began to grow again following increased soil moisture, response was more rapid in muck soil. In addition, the greater early-season damage to leaves from potatoes growing in muck soil, may well indicate that higher quantities of imidacloprid remained available for uptake from that soil after moisture conditions improved. CPB populations in the field were relatively low in 1995. Although marketable yields in CONTROL plots were lower than those from plots treated with ADMIRE in the planting furrow, losses were not statistically significant.

RESIDUES: The limit of detection for imidacloprid in both soil and crops was 0.05 ppm. On day 26, imidacloprid residues measured 0.17 ppm in leaves harvested from potatoes growing in mineral soil; on the same day, no residues of imidacloprid could be detected in leaves of potatoes growing in muck soil. Imidacloprid residues on day 21 measured 1.15 ppm in loam and 1.20 ppm in muck soil. Following harvest, 103 d after treatment, imidacloprid residues of 0.16 ppm and 0.33 ppm were respectively measured in loam and muck soils.

Table 1. Effect of soil type on marketable yield and duration of potato foliage protection by furrow application of imidacloprid to potatoes.

No.	Treatment	Soil Type	% Damage Reduction on Indicated Day** Day 19	Day 26	Day 33	Day 40	Day 47	Day 55	Day 61
1	ADMIRE 240F*	loam	90.3	90.1	83.0	44.9	50.9	7.3	27.1
2	ADMIRE 240F	muck	45.0	30.2	30.4	14.1	2.6	42.1	33.6
3	CONTROL***	loam	9.7	9.3	9.4	8.5	8.5	9.9	9.0

No.	Treatment	Soil Type	% Damage Red'n on Indicated Day Day 68	Day 73	Marketable Yield (t/ha)
1	ADMIRE 240F	loam	64.4	28.2	38.5 a****
2	ADMIRE 240F	muck	9.2	6.0	38.6 a
3	CONTROL	loam	9.6	8.9	30.7 a

* Rate of application - 2.5 g ai/100 m.

** Relative to feeding damage in leaves from CONTROL plots (Tmt. 3).

*** Actual 72 h Damage Rating (0-10 scale where 0 represents no feeding damage, 5 represents 50% loss of leaf area, 10 represents 100% consumption of the leaf).

**** Means within a column followed by the same letter are not significantly different (P = 0.05) as determined by Duncan's New Multiple Range Test.

#066 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100104

CROP: Potato, cv. Kennebec

PEST: Potato leafhopper, *Empoasca fabae* (Harris)

NAME AND AGENCY:

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TITLE: EFFECTS OF VARIOUS RATES OF ADMIRE FOLIAR TREATMENTS ON THE CONTROL OF POTATO LEAFHOPPER ADULTS (PLHA), 1995

MATERIALS: ADMIRE (imidacloprid); RIPCORD (cypermethrin)

METHODS: At the Cambridge Research Station, potatoes were planted on May 8, 1995, in four-row plots that were 15 m long. Rows were spaced 0.9 m apart and plots were separated by 3 m fallow spray lanes. Treatments were arranged in a randomized complete block design with four replications. Insecticides were applied with a tractor-mounted, four-row boom sprayer that delivered 800 L/ha at 450 kPa. The foliar program to control PLHA was initiated on July 20 when the leafhopper population was increasing. An additional spray was applied on July 27. Counts were recorded weekly by taking 10 sweeps from the centre two rows of each plot using a 37.5 cm diameter sweep net and examining the contents for leafhoppers. An assessment of leafhopper burn was estimated on July 20, August 1, 10 and 18. Plots were given a leaf burn rating from 0.0 to 5.0 based on examination of the foliage of 10 plants; where: 0 = no damage; 1.0 = yellow tip; 2.0 = brown tip, yellow margin, and/or some curl; 3.0 = curling and yellowed leaf area; 4.0 = up to half of leaf brown and dry; 5.0 entire leaf dead.

RESULTS: As presented in table.

CONCLUSIONS: The high rate of ADMIRE and RIPCORD provided control of potato leafhoppers after a single spray. The lower rate of ADMIRE required two applications to attain similar control. When control was established all treatments maintained this control for two weeks following the final spray.
All treatments significantly reduced the amount of leafhopper burn on the foliage.

Table 1. Number of potato leafhopper adults per 10 sweeps and the hopper burn rating on potato cv. Kennebec, 1995.*

		Potato leafhopper adults			Hopper burn rating	
Treatment	g ai/ha	July 25	Aug 1	Aug 10	Aug 10	Aug 18
ADMIRE 240FS	25	21.3ab	9.8b	11.5c	0.0b	1.1b
ADMIRE 240FS	50	11.0b	8.3b	21.0bc	0.0b	1.1b
RIPCORD 400EC	35	7.3b	0.8b	3.5c	0.6b	1.3b
Unsprayed check	--	41.5a	89.5a	127.0a	2.3a	2.5a
ANOVA (P• 0.05)		---	---	----	---	---

* Means in each column followed by the same letter are not significantly different at P• 0.05 (Tukey's Studentized Range Test).
Insecticides were applied on July 20 and 27.

#067 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 84100737

CROP: Radish, cv. Rebel

PEST: Cabbage maggot, *Delia radicum* (L.)

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TITLE: INSECTICIDE SEED COATINGS FOR CABBAGE MAGGOT CONTROL

MATERIALS: TRIGARD 95% (cyromazine); LORSBAN 48% (chlorpyrifos); BIRLANE (chlorfenvinphos); SEVIN 50% (carbaryl)

METHODS: Two trials were conducted; one trial on muck soil at the Muck Research Station, Holland Marsh, Ontario, and the other on mineral soil, Cambridge Research Station, Cambridge, Ontario. The experimental plot was arranged in a randomized complete block design with four replications. Each row measured 4 m long and was spaced 40 cm apart. Commercial film seed coating (Bejo FILMKOTE) were provided by Bejozaden Ltd., Warmenhuizen, Holland. The seed was planted by an Earthway precision garden seeder. There were three planting dates at each location - May 29, June 23 and August 21 (muck soil), and May 26, June 23 and August 16 (mineral soil), 1995. The number of plants in a 2-m section of row were counted for initial plant stand. In the first planting, the width of ten leaves per replicate at the two-leaf stage were measured to determine any phytotoxic effects. At harvest all plants in the 2-m section of row were pulled, examined for cabbage maggot damage and weighed for yield.

RESULTS: As presented in table.

CONCLUSIONS: In comparing leaf width, phytotoxicity was noted in plots with seed treated with BIRLANE and SEVIN on muck and mineral soils. There was less phytotoxicity with seed treated with TRIGARD. On muck soil, in the first planting, Birlane was more effective than TRIGARD or SEVIN in controlling the cabbage maggot. On mineral soil, LORSBAN, BIRLANE and SEVIN, and in the first planting the higher rate of TRIGARD controlled the cabbage maggot. In comparing the yields with the different seed treatments the lower rate of LORSBAN had the highest yield. The lower rate of LORSBAN was an effective seed treatment in controlling the cabbage maggot and had the highest yield of the seed treatments on muck and mineral soils. The third planting data are not presented because the cabbage maggot damage was less than 1% in the untreated rows on the muck and mineral soils.

Table 1. Leaf width, initial stand, percent maggot damage and yield following the indicated seed treatment at seeding on muck and mineral soils.

Muck soil		1st Planting				2nd Planting		
Seed treatment	Rate g ai/kg seed	Leaf width (cm)	Initial stand count	% maggot damage	Yield kg/2 m	Initial stand count	% maggot damage	Yield kg/2 m
		7/6	7/6	7/7	7/7	12/7	15/8	15/8
TRIGARD	20	1.93c*	127ab	12.0ab	3.0c	125bc	7.2a	2.0b
TRIGARD	25	1.99bc	116bc	11.0ab	2.6c	125bc	8.8a	2.1b
LORSBAN	20	2.08ab	135a	5.7bc	4.0a	133ab	9.4a	2.4ab
LORSBAN	25	2.15a	130ab	7.3abc	3.5ab	136ab	9.7a	2.2b
BIRLANE		1.64d	120ab	1.6c	3.1bc	110c	6.1a	1.9b
SEVIN	50	1.37e	103c	8.3ab	1.5d	74d	5.1a	1.2c
Check	--	2.09ab	135a	13.5a	3.4b	145a	12.0a	2.7a
ANOVA (P• 0.05)		0.13	17	6.8	0.6	19	ns	0.5
Mineral soil		16/6	16/6	11/7	11/7	14/7	17/8	17/8
TRIGARD	20	2.83b*	112a	10.5ab	2.5b	81b	14.5a	2.8c
TRIGARD	25	2.84b	111a	5.2bc	2.5b	80b	18.8a	2.4c
LORSBAN	20	3.20a	117a	0.7c	3.5a	113a	8.3b	4.0a
LORSBAN	25	3.33a	113a	1.3c	2.9b	107a	7.5b	3.5b
BIRLANE		2.56c	57b	1.3c	1.8c	62c	4.3b	2.8c
SEVIN	50	2.07d	43b	1.2c	0.9d	37d	6.2b	1.3d
Check	--	3.19a	128a	12.9a	2.7b	106a	13.9a	3.4b
ANOVA (P• 0.05)		0.25	21	7.5	0.5	14	6.9	0.4

* Means followed by the same letter are not significantly different (P• 0.05; LSD test).

#068 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61002030

CROP: Soybean, cv. Conrad

PEST: Seed corn maggot, *Delia platura* (Meig.)

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TITLE: SEED TREATMENTS FOR THE CONTROL OF SEED CORN MAGGOT (SCM) IN SOYBEANS

MATERIALS: AGROX B-3 (diazinon 11% + lindane 16.6% + captan 33.5%);
AGROX D-L PLUS (diazinon 15% + lindane 25% + captan 15%);
ANCHOR (carbathiin 66.7 g/L + thiram 66.7 g/L);
UBI-2016-3 (carbathiin + thiram + lindane; 118 + 105 + 149 g ai/L);
UBI-2654 (lindane 300 g ai/L), UBI-2701 (bifenthrin 80 g ai/L);
VITAFLO 280 (carbathiin 14.9% + thiram 13.2%)

METHODS: The site was located at Ridgetown, Ontario, on a sandy-loam soil near a manure storage pit. Adult SCM were attracted to the plots by discing solid cattle manure in 4 week prior to planting and monitored their population using yellow sticky cards. Plots were planted on 19 May 1995, when there were 2-5 adults/yellow sticky card/d. Plots were planted in 3 m rows spaced 0.76 m apart at 100 seeds/plot, using a John Deere Max-emerge planter which was fitted with a cone seeder. Plots were single rows, arranged in a randomized complete block design with four replications. Seeds were treated in 300 g lots and rolled in plastic bags until thoroughly covered (about 30 s). Slurries were made with 50 g dry material in 100 ml water. On 5 June, percent emergence was calculated by counting all the plants emerged per plot at the first leaf stage and relating that to the total number of seeds planted. On the next day, percent infestation was calculated as the proportion of seedlings showing maggot injury relative to the number of seedlings dug up in a 2 m section of row. Non-emerged seeds/seedlings were included in the calculation.

RESULTS: As presented in table.

CONCLUSIONS: All products, except UBI-2016-3, significantly improved emergence of the soybeans compared with Vitaflo or Anchor controls (Table 1). The numerically greatest emergence was obtained using VITAFLO 280 plus the higher rate of lindane (UBI-2654), but this was not significantly different from treatments 3, 6, 7, 8 and 10. Incidence of SCM in seedlings was variable. Therefore, no conclusions could be drawn from those data

Table 1. Control of seed corn maggot in soybeans with seed treatment insecticides at Ridgetown, Ontario, 1995.

Treatment	Product Rate (ml or g/kg seed)	Percent Emergence	Percent Plants Infested
1 VITA. 280 (control)	2.6	63 d	21 abc
2 ANCH. (control)	6.0	64 d	32 a
3 B3 (dry)	3.2	83 ab	12 bc
4 VITA. 280 + DL Plus (dry)	2.6 + 2.2	78 bc	22 abc
5 VITA. 280 + B3 (dry)	2.6 + 3.2	79 bc	21 abc
6 VITA. 280 + DL Plus (SL)	2.6 + 2.2	89 ab	20 abc
7 VITA. 280 + B3 (SL)	2.6 + 3.2	83 ab	27 ab
8 ANCH. + DL Plus (dry)	6.0 + 2.2	84 ab	12 bc
9 ANCH. + B3 (dry)	6.0 + 3.2	78 bc	14 abc
10 VITA. 280 + UBI-2701	2.6 + 1.9	85 ab	10 c
11 VITA. 280 + UBI-2701	2.6 + 3.8	80 b	17 abc
12 VITA. 280 + UBI-2654	2.6 + 2.2	79 bc	21 abc
13 VITA. 280 + UBI-2654	2.6 + 3.3	93 a	16 abc
14 VITA. 280 + UBI-2654 + UBI-2701	2.6 + 2.2 + 1.9	79 bc	21 abc
15 UBI-2016-3	3.3	66 cd	26 abc
CV (%)		8.8	28.6

Means followed by same letter do not significantly differ (P = .05, Duncan's MRT). Data were transformed by ARCSIN(SQR(%)) before ANOVA and mean separation. Reported means were untransformed. SL = slurry application, dry = dust application, VITA. = VITAFLO 280, ANCH. = ANCHOR, B3 = AGROX B-3, DL Plus = AGROX D-L PLUS.

#069 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 387-1411-8717

CROP: Sugarbeet

PEST: Sugarbeet root maggot, *Tetanops myopaeformis* (Roder)

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TITLE: INCIDENTAL CONTROL OF EMERGING SUGARBEET ROOT MAGGOT FLIES WITH SPRAYED INSECTICIDES

MATERIALS: LORSBAN 4E (chlorpyrifos); DECIS 5EC (deltamethrin)

RATIONALE: Anecdotal reports from growers of sugarbeets suggested that early season spraying for control of cutworms in sugarbeet fields, or adjacent fields that had been in sugarbeets the previous year, had the incidental effect of reducing the likelihood of subsequent infestation by sugarbeet root maggot (SBRM). It was speculated that the residues of some insecticides retained activity long enough to kill newly emerged or emerging SBRM flies. This test was conducted to determine the effect of early season spraying of a source field (a field that had been infested by SBRM the previous year) on the emergence of SBRM flies.

METHODS: The test was conducted at Coaldale, AB, in a field which had been in sugarbeets in 1994 and was in soft white spring wheat in 1995. Since most sugarbeet growers in southern Alberta effectively control SBRM, selection of the test site was delayed until a field with an adequate population of SBRM could be identified. Because seagulls are known to congregate in fields where large numbers of SBRM flies are emerging, growers were asked to inform us if they noticed seagulls feeding in fields that had been in sugarbeets in 1994, and it was from this information that the test site was selected. Plots were 3 m x 9 m, replicated four times in a complete block design. Treatments were applied between 10:00 to 10:30 a.m. on June 13, 1995 at a volume of 70 L/ha with a 6 nozzle boom sprayer equipped with 110-02 nozzles. The wheat was at the three-leaf stage. Three pyramidal frame, screen covered emergence traps were placed in each plot (12/treatment) between 1:30 to 3:30 p.m. the same day. Each trap enclosed a 1 m x 1 m area of ground. Emerging flies entered an inverted funnel and glass jar collection device at the top of the trap. Catches were collected at intervals until the test was terminated on July 7 to clear the field for wheel move irrigation. The flies were sorted to species using a stereomicroscope.

RESULTS: As presented in the tables. In southern Alberta the SBRM has a bimodal pattern of emergence with one peak in early June and another in early July (Harper, 1962, Can. Entomol. 94:1334-1340). Initially both Lorsban and Decis drastically reduced the number of SBRM flies caught in the traps (Table 1). However, only Decis controlled the SBRM flies emerging during the early July peak (2-3 weeks post-application).

In addition to SBRM, substantial numbers of two other species of small flies, the seedcorn maggot (*Delia platura* (Meigen)) and a lauxaniid (*Camtoprosopella borealis* Shewell) also emerged during the test period. Initially both Lorsban and Decis significantly reduced the numbers of seedcorn maggot flies emerging, although Lorsban was the most effective (Table 2). However, after about two weeks neither insecticide had an effect. The lauxaniid did not begin emerging in numbers until one week after application of the insecticides and was susceptible to the residues of both, but particularly those of Decis (Table 3).

CONCLUSIONS: Treatment of a SBRM source field with either Lorsban or Decis for cutworm control could secondarily reduce the population of SBRM and lessen the level of infestation in adjacent fields of sugarbeets. Because residues of Decis appear to retain activity for at least three weeks, Decis would likely provide the greatest incidental benefit.

Table 1. Number of sugarbeet root maggot flies emerging from control and treated plots

		Number of flies emerging*						
Treatment	Rate g ai/ha	June 15	June 19	June 22	June 26	June 30	July 7	Total
Control	0	11.0a	18.3a	3.0a	3.8a	1.5ab	14.3a	51.8a
Lorsban	500	2.5b	4.0b	1.8a	1.3b	3.5 a	21.8a	34.8b
Decis	10	1.8b	1.0b	1.3a	0.3b	0.0b	3.3b	7.5c

* Mean number of flies caught in the three emergence traps in each plot. Values followed by the same letter within a column are not significantly different according to a Duncan's Multiple Range Test (P>0.05).

Table 2. Number of seed corn maggot flies emerging from control and treated plots.

Treatment	Rate ai/ha	Number of flies emerging* June 15	June 19	June 22	June 26	June 30	July 7	Total
Control	0	12.8a	37.3a	20.0a	23.0a	8.8a	9.0a	110.8a
Lorsban	500	0.3b	5.0b	4.3b	19.0ab	10.0a	10.8a	49.3b
Decis	10	1.3b	13.3b	14.3a	10.5b	9.3a	7.0a	55.5b

* Mean number of flies caught in the three emergence traps in each plot. Values followed by the same letter within a column are not significantly different according to a Duncan's Multiple Range Test (P>0.05).

Table 3. Number of lauxaniid flies emerging from control and treated plots.

Treatment	Rate g ai/ha	Number of flies emerging* June 15	June 19	June 22	June 26	June 30	July 7	Total
Control	0	0	3.0	29.3a	188.5a	96.5a	28.5a	442.8a
Lorsban	500	0	0	0	63.8b	30.0b	26.0b	119.8b
Decis	10	0	0	0	0.8c	1.5c	1.3c	3.5c

* Mean number of flies caught in the three emergence traps in each plot. Values followed by the same letter within a column are not significantly different according to a Duncan's Multiple Range Test (P>0.05).

#070 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 280-1252-9304

CROP: Tomato, cv. Roadside Red

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: EVALUATION OF PLANTING WATER (PW) TREATMENTS FOR CONTROL OF COLORADO POTATO BEETLE ATTACKING TOMATOES ON MINERAL SOIL

MATERIALS: ADMIRE 240 F (imidacloprid); ORTHENE 75 SP (acephate)

METHODS: Tomato seedlings were grown singly in plastic propagation-plug trays each containing 8 rows of 16 plugs. On 1 June, 96 h prior to planting, Tmt. 5 and 6 (Table 1.) were applied at 150 kPa in 8.0 ml/plug using a single-nozzled (8004 flat fan) Oxford precision sprayer. Treated plants (15-17 cm tall) were immediately flushed with 2-3 L water/tray to rinse the insecticide from the foliage and down into the planting medium of individual plugs. All treatments (15 plants/tmt.) were planted at the London Research Farm on 5 June in 3-row microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free mineral soil. All treatments were replicated 3 times in a randomized complete block design. Tmts. 5,6 and 8 received only 150 ml starter fertilizer (soluble 10-52-10 [N-P-K] at 2.5 g/L) in the planting hole. The desired rate of insecticide was added to starter solution for Tmts. 1-4 and 7. Individual seedlings were established in planting holes as soon as possible after adding planting water. Within 0.5 h of planting Tmts. 5-8, a total of 4 leaves were harvested from each plot of each tmt. (12 leaves/tmt.), pooled together, and returned to the laboratory for bioassay. A total of 5 bioassays, each containing 2 leaves and 5 adult insecticide-susceptible CPB adults was established for each treatment. Bioassays were held at 25•C, 55% RH, and 16:8 L:D photoperiod. Mortality and leaf damage were recorded after 24, 48 and 72 h. Leaves were thereafter collected from all treatments at regular intervals for further bioassay (Table 1). To accommodate increasing growth, the centre of row of plants was removed from each microplot on 20 June. On 19 June, to measure levels of imidacloprid in soil soon after planting, soil samples were collected immediately adjacent to plants slated for removal in Tmts. 1-4, 6 and 8. Similar samples were collected from beneath remaining plants on 1 September. Plants were removed and plots were spaded and cultivated on 19 September; random soil samples were then collected from the same treatments. At first-ripe fruit, samples of ripe fruit were collected for residue analysis from Tmt. 2-4, 6 and 8 on 17 August. Additional fruit samples were collected 1 September. All residues of imidacloprid were determined using HPLC by the Analytical Chemistry Services Group in the London laboratory of the Pest Management Research Centre.

RESULTS: As presented in the table. For the sake of brevity, only % reduction in damage to leaves by adults feeding for 72 h is shown. No phytotoxicity was noted following either preplant drench application or any PW treatment.

CONCLUSIONS: Residues of imidacloprid in leaves of tomato seedlings subjected to drench application 96 h prior to planting provided virtually complete control of CPB feeding damage to leaves harvested within 0.5 h of planting. The higher rate of drench application of ADMIRE reduced CPB feeding damage by at least 75% for 28 d after planting; the lower rate remained effective for 21 d. All ADMIRE PW treatments provided excellent protection of tomato foliage 1 d after planting. Damage reduction greater than 90% was observed for at least 14 d following PW application of ADMIRE at 1.0 mg a.i./plant and exceeded 75% for at least 49 d following PW application of 7.5 mg a.i./plant. Reduced CPB feeding damage correlated with the rate of application of ADMIRE, ie. the higher the rate of application, the longer the duration of leaf protection. PW application of ORTHENE, the commercial standard, afforded only 43% damage reduction within 2 d of planting, rising to 88% after 7 d and then falling below 25% within the next 7 d. Economic effectiveness of ORTHENE at the label rate of application would appear to be less than 14 d. On 2 occasions (days 42 and 63) protection by most treatments improved relative to that observed on the previous sampling date. On each occasion microplots had received at least 10 mm of water from either irrigation or rainfall within the previous 4-6 days, alleviating dry periods of 16 and 18 d respectively. It is felt that both moistening of soil and resumption of growth resulted in imidacloprid uptake from soil, increasing toxicity of leaves to CPB in bioassay.

Table 1. Duration of foliage protection by pre-plant and planting water application of insecticides to tomato seedlings.

No	Treatment	Rate (mg AI/ plant)	Method	% Damage Reduction on Indicated Day****						
				Day 0	Day 1	Day 2	Day 7	Day 14	Day 21	Day 28
1	ADMIRE 240F	1.0	PW*	--***	92.2	94.4	94.6	95.1	68.6	14.4
2	ADMIRE 240F	2.5	PW	--	94.4	97.4	95.9	96.6	93.9	71.5
3	ADMIRE 240F	5.0	PW	--	95.2	97.0	96.3	97.2	93.9	84.8
4	ADMIRE 240F	7.5	PW	--	96.2	98.0	97.6	96.8	95.3	92.4
5	ADMIRE 240F	2.5	DR**	97.0	98.0	98.4	97.2	92.1	83.1	40.8
6	ADMIRE 240F	5.0	DR	98.2	98.0	98.2	97.4	95.9	92.9	78.8
7	ORTHENE 75SP	65.0	PW	0.0	0.0	43.2	88.7	24.0	15.1	17.7
8	CONTROL*****	----	PW	10.0	10.0	10.0	9.2	9.3	7.6	7.4

No	Treatment	Rate (mg AI/ plant)	Method	% Damage Reduction on Indicated Day					
				Day 35	Day 42	Day 49	Day 56	Day 63	Day 70
1	ADMIRE 240F	1.0	PW	0.0	7.4	0.4	0.6	4.6	1.8
2	ADMIRE 240F	2.5	PW	0.0	43.4	67.6	3.1	71.0	66.0
3	ADMIRE 240F	5.0	PW	22.1	75.9	88.2	40.2	74.0	44.2
4	ADMIRE 240F	7.5	PW	75.5	89.3	89.4	68.4	82.2	78.8
5	ADMIRE 240F	2.5	DR	0.0	0.8	0.0	2.6	18.2	21.6
6	ADMIRE 240F	5.0	DR	23.9	43.8	41.4	35.8	39.8	72.4
7	ORTHENE 75SP	65.0	PW	0.0	0.0	5.9	0.6	0.6	0.0
8	CONTROL	----	PW	9.0	9.7	9.8	10.0	10.0	10.0

* Planting water treatment.
** Drench application 96 h prior to planting.
*** Bioassay not undertaken.
**** Relative to feeding damage in leaves from CONTROL plots (Tmt. 8).
***** Actual 72 h Damage Rating (0-10 scale where 0 represents no feeding damage, 5 represents 50% loss of leaf area, 10 represents 100% consumption of the leaf).

RESIDUES: Results of analyses imidacloprid residues are shown in Table 2. For PW treatments, imidacloprid residues in soil declined approximately 70% from day 14 to day 87. Tilling plots and the passage of 18 d resulted in a further 90% decline in soil residues, emphasizing the importance of soil dilution in dissipation of soil residues. A similar relationship was observed for preplant drench application of ADMIRE. Since imidacloprid was not detected (0.05 ppm limit of detection) in ripe tomatoes harvested 73 d after insecticide application, analyses of extracts of fruit harvested on day 87 were not completed.

Table 2. Pesticide residues measured in soil and tomato samples.

No	Treatment	Rate (mg ai/ plant)	Method	Measured Residues (ppm)			
				Soil Day 14	Soil Day 87	Soil Day 105	Tomato Day 73
1	ADMIRE 240F	1.0	PW*	1.13	--****	--	<0.05
2	ADMIRE 240F	2.5	PW	2.59	0.75	0.06	<0.05
3	ADMIRE 240F	5.0	PW	3.09	1.04	0.08	<0.05
4	ADMIRE 240F	7.5	PW	5.01	1.48	0.16	<0.05
6	ADMIRE 240F***	5.0	DR**	2.44	0.57	<0.05	<0.05
8	CONTROL	---	---	<0.05			<0.05

* Planting water treatment.

** Drench application 24 h prior to planting.

*** Add 4 d to Day Number for each residue determination.

**** Residue not determined.

ENTOMOLOGY / ENTOMOLOGIE

MEDICAL AND VETERINARY / MÉDICAL ET VÉTÉRINAIRE

Section Editor / Réviseur du section : D. Colwell

#071 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100101

HOST: Angora goat, *Capra hircus angorensis*

PEST: Biting louse, *Damalinia crassipes* (Rudow)

NAME AND AGENCY:
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TITLE: EFFICACY OF 0.25% DELTAMETHRIN TO CONTROL BITING LICE ON ANGORA GOATS

MATERIALS: Deltamethrin, 0.25% w/w, Hoechst-Roussel Agri-Vet Company, Route 202-206, P.O. Box 2500, Somerville, NJ, 08876-1258

METHODS: The objective of this study was to determine whether 0.25% deltamethrin applied at two different dosages (20 ml or 50 ml per animal) could effectively control biting lice on Angora goats. A flock of Angora goats was observed from 27 January to 17 April 1995 to fulfil this objective. Hoechst Canada recommended that goats receive 10 ml of 0.5% deltamethrin applied as a pour-on. Because of previous control failures using DeLice® as a pour-on it was decided to use 20 or 50 ml of 0.25% deltamethrin applied with a 500 ml hand mister. By increasing the volume of product applied and varying the location of product application (total body coverage versus pour-on along back line only) we hoped to improve the efficacy of louse control.

Animals were housed in an unheated barn near Elora, Ontario. Initially two groups of four animals (pregnant does) were selected to receive treatment. The four most heavily infested goats were treated on 27 January 1995 with 20 ml of 0.25% deltamethrin. Product was applied to all regions of the body and then rubbed into the fleece, with the applicator wearing latex gloves, to improve penetration. Four other infested goats were maintained as non-treated controls. The four treated animals were penned together (separate from all other goats), whereas the non-treated animals remained with the other members of the herd.

An index of louse populations on each animal was determined using a method similar to Schemanchuck *et al.* 1963 (Can. J. Animal Sci. 43: 56-64). The number of lice seen in 46 hair parts (• 6 cm in width) on six body regions of each animal (i.e. neck, back line, sides, tailhead, back of hind leg and belly) were recorded at each sampling interval. All louse counts were made by the same observer. Goats were examined for lice prior to treatment and 7 d post-treatment. Percent reduction of louse populations on treated animals was determined for each sampling interval using a modified Abbott's formula (Neal J. W. Jr., 1976. A manual for determining small dosage calculations of pesticides and conversion tables. Entomol. Soc. Amer. College Park, MD.): 100% - ((treated after/treated before) x (non-treated before/non-treated after)).

Following the first treatment, all goats were sheared on 6 March 1995. The four animals previously treated with 20 ml of 0.25% w/w deltamethrin were retreated with 50 ml and four non-treated animals were used as controls. Louse indices were performed on these animals at 0 and 7 d post-treatment. Following the louse counts at 7 d post-treatment, the 4 control animals and all remaining non-treated goats were treated with 20 ml of product. These animals were re-examined at 7, 14, 21 and 35 d post-treatment and after lice were counted on day 14, goats were retreated with 20 ml of product.

Each adult goat weighed about 60 kg (125 lb) and all were maintained on commercial feed throughout the study.

RESULTS: All lice seen on goats were biting lice, *Damalinia crassipes*. The product failed to control lice on goats when initially applied at 20 ml 0.25% deltamethrin w/w per animal (Table 1). This failure was likely due to poor penetration of the product because at the time of treatment the fleece on these animals was very dense and long (>23 cm). Following shearing, animals were retreated with 50 ml of product to ensure adequate coverage. Control was complete when goats were treated once with 50 ml of product; however, when non-treated controls were treated with 20 ml of product, a second treatment was required to completely eliminate lice (Table 1).

CONCLUSIONS: Deltamethrin effectively controlled biting lice on Angora goats provided the fleece of treated animals was short at the time of treatment. Treating goats in full fleece was unproductive with little or no reduction in louse numbers. We recommend that animals be sheared if synthetic pyrethroids are used to control lice on goats. A single application of 50 ml of 0.25% deltamethrin provided complete control of lice; however, if smaller volumes of product are used, animals should be retreated at 7 or 14 d intervals to ensure that lice are eliminated.

Table 1. Louse indices and percent reduction in biting lice (*Damalinia crassipes*) on Angora goats (weighing • 60 kg each) treated with two doses of 0.25% deltamethrin (Hoechst Canada).

Days Post-treatment	Mean louse index/animal[a] (percent reduction[b])		
	Non-treated	Deltamethrin @ 20 ml/animal	Deltamethrin @ 50 ml/animal
Prior to shearing			
Pre-treatment	37.5	328.5 (--)	ND
7	34.7	388.7 (-1.2)	ND
After all animals sheared			
Pre-treatment	96.5	42.0 (--)	194.7 (--)
7	42.0	3 (>98.0)	0 (100)
14[c]	ND	1 (>99.0)	0 (100)
21	ND	0 (100)	0 (100)
35	ND	0 (100)	0 (100)

[a] Indices were modified after Schemanchuck *et al.*, 1963 (Can. J. Animal Sci. 43: 56-64) and was based on four animals per group.

[b] Calculated using Neal's formula: Percent reduction = 100% - ((treated after/treated before) X non-treated before/non-treated after)).

[c] Goats in previously non-treated group were re-treated after louse counts were performed 14 d post-treatment.

ND = not done.

#072 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100101

HOST: Beef cattle, mixed cross breeds

PEST: Biting louse, *Damalinia bovis* (L.)
Long-nosed sucking louse, *Linognathus vituli* (L.)

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TITLE: EFFICACY OF 0.5% DELTAMETHRIN AND 1.0% PERMETHRIN POUR-ON FORMULATIONS TO PREVENT INFESTATION OR RE-INFESTATION OF BEEF CATTLE BY LICE

MATERIALS: Deltamethrin 0.5% w/w, Hoechst-Roussel Agri-Vet Company, Route 202-206, P.O. Box 2500, Somerville, NJ, 08876-1258;
Cooper's DeLice™ Pour-on, 1% permethrin, Cooper Agropharm Inc., Ajax, Ontario, L1S 3C5.

METHODS: Twelve naturally infested heifers of mixed breed were used to determine the residual efficacy of deltamethrin and permethrin by housing two treated animals with one non-treated animal. Heifers were randomly assigned to one of four treatment groups. Two heifers were treated with 16.5 and 33 ml of deltamethrin/200 kg of body weight or 15 ml of permethrin/45 kg of body weight. Treatment was applied along the dorsal midline (e.g., withers to tailhead) of each animal. Treated heifers were then housed with one non-treated heifer. A group of three heifers were non-treated controls. Each group of heifers were housed in an unheated enclosed feedlot with slatted floors and treatment groups were separated by at least one pen to avoid physical contact. The weights of all heifers were recorded on each sampling day and animals were maintained on full feed rations of 27.8% corn silage, 47.1% haylage, 20.9% grain and high moisture corn, 2.8 soybean meal and 1.4% mineral/salt premix.

An index of louse populations on each animal was determined using a method similar to Schemanchuk *et al*. 1963. The number of lice seen in 46 hair parts (approximately 6 cm in length) on 5 body regions of each animal (i.e., sides, crest, back line, tailhead and ears) were recorded at each sampling interval. All louse counts were made by the same observer. Heifers were examined for lice prior to treatment and 7, 14, 28 and 42 d post-treatment. After lice were counted on day 14, animals in the permethrin group were retreated. Percent reduction of louse populations on treated animals was determined for each sampling interval using a modified Abbott's formula (Neal 1976): 100% - ((treated after/treated before) x (non-treated before/non-treated after)).

At 3, 7, 14, 28 and 42 d post-treatment, hair samples were collected from the back line, side (approximately 30 cm below midline) and base of foreleg of two non-treated animals, two of the animals treated with 16.5 and 33 ml of deltamethrin and two animals treated with permethrin (i.e., animals from experiment 1 above). The animals sampled were determined randomly (1st and 3rd animal into the squeeze). Hair samples were individually stored in plastic ziplock bags and transferred to the laboratory. The comb and scissors used to collect the hair samples were rinsed with 100% ethyl alcohol after each sample to avoid cross-contamination.

Live *Damalinia bovis* from two non-treated steers, which were not otherwise involved in the study, were collected during each sampling interval using a fine toothed nit comb. Lice were kept warm (>30°C) during transfer to the laboratory. Groups of 10 or 15 adult *D. bovis* were placed in 7 ml plastic vials using featherlite forceps. Lice were examined under a dissecting microscope prior to placement on the hair samples to ensure only healthy and active lice were used. Aliquots of hair (0.03 g) from the three body regions from each animal were placed into two Petrie dishes (7.5 X 50 mm) with lids covered with 0.01 mm^2 nylon mesh. The groups of lice were placed on top of hair samples <4 h after being collected. Petrie dishes containing lice were held at room temperature (22°C) within plastic container that maintained >95% relative humidity. Initially, mortality of lice was assessed 2, 14 and 24 h after being placed on the hair samples; however, the 2 h assessment was discontinued because few lice were dead at this time.

Differences in the number of lice dead after 24 h exposure to treated (3 treatment groups) and non-treated hair samples from the same body region were compared statistically using analysis of variance ($p<0.05$). When significant differences were observed among treatments, means were compared using Scheffe's comparison of means. Differences in mortality of lice exposed to treated hair samples collected on different sampling dates and from difference body regions (analysed by treatment group) were also compared using these tests.

RESULTS: When treated animals shared pens with non-treated animals, lice on treated animals were reduced by at least 92.8 and 98.8% when treated with DeLice® and deltamethrin, respectively (Table 1). Louse populations on non-treated animals were reduced by >85% after 14 d of being housed with heifers treated with deltamethrin (Table 1). With one exception (7 d post-treatment), both dosages of deltamethrin prevented treated heifers from becoming re-infested by lice. DeLice® provided comparable protection from re-infestation although more lice were observed on heifers treated with DeLice® than deltamethrin (Table 1).

Three to seven days post-treatment, more than 90% of lice were killed by exposure to hair samples from animals treated with DeLice® and deltamethrin (Tables 2 and 3). During these periods, significantly fewer lice were killed by exposure to the non-treated hair than any of the three other treatments. Clearly, by 7 d post-treatment each of the three compounds had dispersed at least to the base of the foreleg of treated animals. The proportion of lice killed by exposure to treated hair decreased on subsequent sampling dates although no less than 65 (DeLice®), 81 (16.5 ml of deltamethrin) and 86% (33 ml of deltamethrin) of the lice exposed to hair from treated animals were killed by exposure to these compounds (Tables 2 and 3). From 14 to 42 d post-treatment, significantly fewer lice were killed by exposure to hair treated with DeLice® or non-treated hair than lice exposed to hair from animals treated with either dose rate of deltamethrin.

The proportion of lice killed by exposure to hair from the base of the foreleg, side or back line of treated animals did not differ significantly within each treatment group (Tables 2 and 4). However, significantly more lice were killed when exposed to the deltamethrin treated hair samples (both dose rates) than lice exposed to hair from non-treated animals. Significantly more lice were killed when exposed to hair from the back line of animals treated with DeLice® than lice exposed to hair from non-treated animals. No significant differences were observed between mortality of lice exposed to hair from the sides or base of the foreleg of DeLice® treated or non-treated animals.

CONCLUSIONS: Housing treated cattle in the same pens as non-treated animals at a ratio of 2:1 can successfully decrease louse numbers on non-treated animals without subsequent re-infestation of treated animals. However, based on the bioassay experiment, treated and non-treated animals must be placed together within 3-7 d after treatment to maximize reduction of lice on non-treated animals. When two treated animals were housed with a non-treated animal, deltamethrin reduced louse numbers by >98% and >85% on treated and non-treated animals, respectively. In order to maximize the spread of insecticide among animals, animals should be grouped together within 3-7 d of initial product application because products dissipate over time as does the level of mortality caused to lice.

REFERENCES:

Neal, J.W. Jr. 1976. A manual for determining small dosage calculations of pesticides and conversion tables. Entomol. Soc. Amer. College Park, MD.

Shemanchuk, J.A., Haufe, W.O. and C.O.M. Thompson. 1963. Effects of some insecticides on infestations of the short-nosed cattle louse. Can. J. Animal Sci. 43: 56-64.

Table 1. Louse indices and percent reduction in biting lice (*Damalinia bovis*)[1] on beef cattle treated with DeLice® (1% permethrin) and two doses of 0.5% deltamethrin (Hoechst Canada) and housed with one non-treated animal.

Days Post-treatment	Mean louse index/animal[2] (percent reduction[3])						
	Non-treatment	DeLice®		Deltamethrin @ 16.5 ml/200 kg		Deltamethrin @ 33.3 ml/200 kg	
		T	N	T	N	T	N
Pre-treatment	95.3	41.5 (--)	27 (--)	65.0 (--)	69 (--)	60.0 (--)	57 (--)
7	118.3	0 (100)	52 (-55.1)	1.0 (98.8)	0 (100)	0 (100)	10 (85.9)
14	176.7	5.5 (92.8)[4]	2 (16.1)	0 (100)	0 (100)	0 (100)	1 (99.0)
28	101.7	0.5 (98.9)	11 (61.8)	0 (100)	1 (99.2)	0 (100)	0 (100)
42	193.7	0 (100)	2 (97.6)	0 (100)	2 (98.5)	0 (100)	0 (100)

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[1] Greater than 98% of lice were *D. bovis*. Small numbers of *L. vituli* were present on animals and were included within the indices.

[2] Indices was modified after Schemanchuk *et al.*, 1963 and was based on three animals per group.

[3] Calculated using Neal's 1976 formula: Percent reduction = 100% - ((treated after/treated before) X non-treated before/non-treated after)).

[4] Animals in the DeLice® group were re-treated after louse counts were performed.

T = treated animals; N = non-treated animal housed with two treated individuals.

Table 2. Percent mortality of *Damalinia bovis* exposed for 24 h to hair samples from the back line, sides and base of the foreleg of cattle treated with DeLice® (1% permethrin) and two doses of 0.5% deltamethrin (Hoechst Canada).

Sample location & days post-treatment	No. of lice/treatment[1]	Treatment			
		Non-treated	Delice®	Deltamethrin @ 16.5 ml/200 kg	Deltamethrin @ 33 ml/200 kg
Back line					
3	180	41.7	96.7	100	100
7	180	31.7	100	100	98.3
14	120	45.0	87.5	97.5	97.5
28	180	58.3	93.3	96.7	96.7
42	180	50.0	88.3	98.3	96.7
Side					
3	180	40.0	98.3	98.3	100
7	180	51.7	96.7	100	98.3
14	120	30.0	82.5	97.5	95.0
28	180	60.0	56.7	75.0	91.7
42	180	58.3	68.3	80.0	91.7
Base of foreleg					
3	180	48.3	96.7	96.7	100
7	180	30.0	75.0	93.3	100
14	120	52.5	50.0	92.5	100
28	180	51.7	45.0	71.7	71.7
42	180	46.7	53.3	76.7	73.3

[1] Lice were exposed to hair samples collected from 2 animals in each treatment group.

Table 3. Percent mortality of *Damalinia bovis* exposed for 24 h to hair samples treated with DeLice® (1% permethrin) and two doses of 0.5% deltamethrin (Hoechst Canada).

Days post-treatment	No. of lice/treatment group	Treatment Non-treated	Delice®	Deltamethrin @ 16.5 ml/200 kg	Deltamethrin @ 33 ml/200 kg
3	180	43.3a[1]	97.2b	98.3b	100b
7	180	37.8a	90.6b	97.8b	98.9b
14	120	42.5a	73.3a	95.8b	97.5b
28	180	56.7a	65.0a	81.1b	86.7b
42	180	51.7a	70.0a	85.0b	87.2b
Over all dates	840	46.7	79.6	91.3	93.8

[1] Percent mortalities within rows followed by the same letter are not significantly different (ANOVA; $p<0.05$).

Table 4. Percent mortality of *Damalinia bovis* exposed for 24 h to hair samples collected from three body regions of beef cattle treated with DeLice® (1% permethrin) and two doses of 0.5% deltamethrin (Hoechst Canada).

Body region	No. of lice/treatment group	Treatment Non-treated	Delice®	Deltamethrin @ 16.5 ml/200 kg	Deltamethrin @ 33 ml/200 kg
Back line	840	45.3a	93.6b	98.6b	97.9b
Side	840	49.3a	80.3a	89.6b	95.3b
Base of foreleg	840	45.3a	65.0a	85.7b	88.2b

[1] Percent mortalities within rows followed by the same letter are not significantly different (ANOVA; $p<0.05$).

#073 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100101

HOST: Beef cattle, mixed cross breeds

PEST: Biting louse, *Damalinia bovis* (L.)
Long-nosed sucking louse, *Linognathus vituli* (L.)

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TITLE: FIELD EVALUATION OF 0.5% DELTAMETHRIN AND 1.0% PERMETHRIN POUR-ON FORMULATIONS TO CONTROL LICE ON BEEF CATTLE

MATERIALS: Deltamethrin 0.5% w/w, Hoechst-Roussel Agri-Vet Company, Route 202-206, P.O. Box 2500, Somerville, NJ, 08876-1258;
Cooper's DeLice™ Pour-on, 1% permethrin, Cooper Agropharm Inc., Ajax, Ontario, L1S 3C5.

METHODS: Twelve naturally infested crossbred heifers (various breeds) were used to determine the efficacy of deltamethrin and permethrin to control louse populations. Three heifers were randomly assigned to each of four treatment groups. Groups of three heifers were either non-treated controls or were treated with 16.5 or 33 ml of deltamethrin/200 kg of body weight or 15 ml of permethrin/45 kg of body weight. The products were applied along the dorsal midline of animals in the treated groups. Animals in either of the deltamethrin groups were treated once (9 January 1995), whereas animals in the permethrin group received 2 treatments 14 d apart (9 and 23 January 1995). Heifers were housed in an unheated enclosed feedlot with slatted floors and animals within each treatment group were housed together. Treated and non-treated animals were separated by at least one pen to avoid physical contact. The weights of all heifers were recorded on each sampling day and animals were maintained on full feed rations of 27.8% corn silage, 47.1% haylage, 20.9% grain and high moisture corn, 2.8 soybean meal and 1.4% mineral/salt premix.

An index of louse populations on each animal was determined using a method similar to

Schemanchuk *et al.* 1963. The number of lice seen in 46 hair parts (approximately 6 cm in length) on 5 body regions of each animal (i.e., sides, crest, back line, tailhead and ears) were recorded at each sampling interval. All louse counts were made by the same observer. Heifers were examined for lice prior to treatment and 7, 14, 28 and 42 d post-treatment. After lice were counted on day 14, animals in the permethrin group were retreated. Percent reduction of louse populations on treated animals was determined for each sampling interval using a modified Abbott's formula (Neal 1976): 100% - ((treated after/treated before) x (non-treated before/non-treated after)).

RESULTS: Greater than 98% of the lice seen on cattle were biting lice, *D. bovis*. Small numbers of sucking lice (*Linognathus vituli*) were present on animals and were included in the louse index. There was no evidence of irritation to animals caused by the treatments and the average weight gains of the six non-treated animals (41.7 ± 14.1 kg; range, 24-57) were not significantly different (p>0.11) from the 18 treated animals (49.7 ± 8.9 kg; range, 37-63).

Both dosage rates of 0.5% deltamethrin and the DeLice® formulation provided a 100% reduction in louse populations on treated heifers for up to 42 d post-treatment (Table 1). Although both products completely eliminated lice on infested cattle, deltamethrin achieved this level of control with a single application, whereas animals in the DeLice® group were re-treated, according to label directions, 14 d after initial treatment. Although it is not known whether one application of DeLice® would have provided the same level of control as two application, use of deltamethrin appears to be more convenient since one application provided complete control of lice.

CONCLUSIONS: Deltamethrin (0.5% w/w) and DeLice® (1% permethrin) completely controlled biting lice on beef cattle. This control persisted for the entire 42 d period of the trial at the low (both products) and high (deltamethrin) dose treatments. There was no evidence of irritation to animals caused by the treatments.

REFERENCES:

Neal, J.W. Jr. 1976. A manual for determining small dosage calculations of pesticides and conversion tables. Entomol. Soc. Amer. College Park, MD.

Shemanchuk, J.A., Haufe, W.O. and C.O.M. Thompson. 1963. Effects of some insecticides on infestations of the short-nosed cattle louse. Can. J. Animal Sci. 43: 56-64.

Table 1. Louse indices and percent reduction in biting lice (*Damalinia bovis*)[1] on beef cattle treated with DeLice® (1% permethrin) and two doses of 0.5% deltamethrin (Hoechst Canada).

Days Post-treatment	Mean louse index/animal[2] (percent reduction[3])			
	Non-treated	DeLice®	Deltamethrin @ 16.5 ml/200 kg	Deltamethrin @ 33.3 ml/200 kg
Pre-treatment	96.7	159.0 (--)	69.3 (--)	48.7 (--)
7	215.3	0 (100)	0 (100)	0 (100)
14	259.3	0 (100)[4]	0 (100)	0 (100)
28	201.3	0 (100)	0 (100)	0 (100)
42	317.7	0 (100)	0 (100)	0 (100)

[1] Greater than 98% of lice were *D. bovis*. Small numbers of *L. vituli* were present on animals and were included within the indices.

[2] Indices was modified after Schemanchuk *et al*., 1963 and was based on three animals per group.

[3] Calculated using Neal's 1976 formula: Percent reduction = 100% - ((treated after/treated before) X non-treated before/non-treated after)).

[4] Animals in the DeLice® group were re-treated after louse counts were performed.

#074 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100101

HOST: Beef cattle, mixed cross breeds

PEST: Horn fly, *Haematobia irritans* (L.)
Face fly, *Musca autumnalis* (DeGeer)

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TITLE: FIELD EVALUATION OF 0.5% W/W DELTAMETHRIN FOR HORN FLY AND FACE FLY CONTROL ON BEEF CATTLE

MATERIALS: Deltamethrin 0.5% w/w, Hoechst-Roussel Agri-Vet Company, Route 202-206, P.O. Box 2500, Somerville, NJ, 08876-1258.

METHODS: Three separate herds of beef cattle of mixed breeds (ca. 40-50 animals/herd) within two kilometres of each other were used in this trial. The two treated herds were on adjacent pastures, separated by a vehicle path. Within each treated herd, animals were held in separate fields in groups of four to six animals. On June 26 one herd was treated with 16.5 ml of 0.5% w/w deltamethrin/200 kg of body weight. Another was treated with 33.0 ml of 0.5% w/w deltamethrin/200 kg of body weight. The product, for both treatments, was poured along the dorsal midline from the crest to the tailhead. The third herd was not treated with anything and served as a control.

At approximately weekly intervals the number of horn flies per one side and the number of face flies per face were counted on ten randomly selected animals in each herd. Counts were made on the same day between 1300 h and 1700 h. Air temperature, wind speed and percent cloud cover were recorded during each sampling interval. Counts were not performed on unseasonably cool days or when high winds (>25 kph) or rain were present. Differences in the number of horn flies or face flies on animals between herds were determined using analysis of variance (ANOVA; *P*• 0.05). Percent reduction of each fly species were determined for each weekly count and over the entire season by comparing the counts on each treated herd with the control herd.

RESULTS: Both dosage rates of deltamethrin provided >98% (season mean) reduction of horn flies over the duration of the trial (Table 1). There were no significant differences in levels of horn fly reduction, throughout the season, between both dosage rates of deltamethrin (ANOVA; *P*• 0.05). Both dosage rates of deltamethrin provided >97% reduction in face flies for one week post-treatment, however, percent reduction dropped to 59% by three weeks post-treatment, becoming negligible by week five (Table 2).

CONCLUSIONS: Deltamethrin (0.5% w/w) provided excellent season-long control of horn flies on beef cattle when applied as a pour-on at 16.5 ml/200 kg body weight and 33.0 ml/200 kg body weight. Face flies were controlled for only two to three weeks post-treatment. There were no ill effects to animals noted.

Table 1. Mean (± SD) number of horn flies on 10 randomly selected beef cattle and percent reduction following application of 0.5% deltamethrin @ 16.5 ml/200 kg and 33.0 ml/200 kg of body weight.

Date	Weeks Post-treatment	Number of Horn Flies Non-treated	0.5 % deltamethrin @ 16.5 ml/200 kg	0.5 % deltamethrin @ 33 ml/200 kg
June 29	0.4	45.7 ± 35.0a	0.0 ± 0.0[1]b (100.0)[2]	0.0 ± 0.0b (100.0)
July 4		144.5 ± 38.2a	0.0 ± 0.0b (100.0)	0.0 ± 0.0b (100.0)
11	2	37.5 ± 31.3a	0.1 ± 0.3b (99.7)	0.0 ± 0.0b (100.0)
19	3	61.1 ± 35.8a	0.0 ± 0.0b (100.0)	0.0 ± 0.0b (100.0)
25	4	41.4 ± 23.9a	0.8 ± 1.3b (98.1)	0.5 ± 0.8b (98.8)
Aug. 2	5	40.3 ± 14.3a	1.6 ± 2.1b (96.0)	1.0 ± 1.1b (97.5)
8	6	40.6 ± 25.0a	1.1 ± 1.2b (97.3)	1.0 ± 1.1b (97.5)
16	7	39.5 ± 18.3a	1.3 ± 1.8b (96.7)	0.3 ± 0.9b (99.2)
22	8	54.5 ± 34.3a	1.6 ± 1.8b (97.1)	0.5 ± 0.7b (99.1)
29	9	80.5 ± 47.3a	1.7 ± 1.2b (97.9)	1.1 ± 1.4b (98.6)
Sept. 5	10	56.2 ± 35.9a	2.4 ± 2.2b (95.7)	1.4 ± 1.5b (97.5)
Season Mean Percent Reduction:		___	98.0	98.9

[1] Means within rows followed by the same letter are not significantly different (ANOVA; *P*• 0.05).

[2] Percent reduction =[(No. of flies on non-treated animals - No. of flies on treated animals)/No. of flies on non-treated animals)] X 100%.

Table 2. Mean (± SD) number of face flies on 10 randomly selected beef cattle and percent reduction following application of 0.5% deltamethrin @ 16.5 ml/200 kg and 33.0 ml/200 kg of body weight.

Date	Weeks Post-treatment	Number of Face Flies		
		Non-treated	0.5 % deltamethrin @ 16.5 ml/200 kg	0.5 % deltamethrin @ 33 ml/200 kg
June 29	0.4	8.1 ± 4.9a	0.1 ± 0.3[1]b (97.5)[2]	0.0 ± 0.0b (100.0)
July 4	1	13.9 ± 8.3a	0.3 ± 0.5b (97.8)	0.1 ± 0.3b (98.6)
11	2	21.8 ± 13.9a	2.4 ± 2.5b (89.0)	1.5 ± 1.9b (93.1)
19	3	19.1 ± 7.6a	7.7 ± 5.0b (59.7)	2.9 ± 2.6b (84.8)
25	4	13.2 ± 11.7a	10.7 ± 5.2a (18.9)	6.5 ± 3.7a (50.7)
Aug. 2	5	3.7 ± 2.0a	12.5 ± 5.8b (0.0)	10.3 ± 5.3b (0.0)
8	6	13.9 ± 5.1a	7.9 ± 4.0b (43.2)	10.4 ± 4.0ab (25.2)
16	7	7.6 ± 6.2a	10.7 ± 5.2a (0.0)	12.7 ± 8.9a (0.0)
22	8	11.8 ± 4.8a	10.5 ± 5.7a (11.0)	13.4 ± 4.9a (0.0)
29	9	7.4 ± 4.1a	10.9 ± 4.7a (0.0)	12.5 ± 9.6a (0.0)
Sept. 5	10	8.0 ± 6.9a	3.8 ± 2.0a (52.5)	6.6 ± 4.6a (17.5)
Season Mean Percent Reduction:		---	42.7	42.7

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[1] Means within rows followed by the same letter are not significantly different (ANOVA; *P*• 0.05).

[2] Percent reduction = [(No. of flies on non-treated animals -No. of flies on treated animals)/No. of flies on non-treated animals)] X 100%. If the mean number of flies was greater on a treated herd than the non-treated herd on a given date, reduction was considered 0.0%.

#075 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100101

HOST: Dairy cattle, Holstiens and Jerseys

PEST: Horn fly, *Haematobia irritans* (L.)
Face fly, *Musca autumnalis* (DeGeer)

NAME AND AGENCY:
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RIPLEY B
Ontario Pesticides Laboratory
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TITLE: CONTROL OF HORN FLIES AND FACE FLIES ON DAIRY CATTLE USING 1% OR 5% PERMETHRIN POUR-ON FORMULATIONS

MATERIALS: Cooper's DeLice™ Pour-on, 1% permethrin, Cooper Agropharm Inc., Ajax, Ontario, L1S 3C5; 5% permethrin pour-on, Mallinckrodt Veterinary Inc., 421 East Hawley St., Mundelein, IL, 60060.

METHODS: Three separate herds of Holstein and Jersey dairy cattle (ca. 25 animals/herd) located within 1 km of each other were used in this trial. During the second week of July, one herd was treated with 150 ml of 1% permethrin (Coopers DeLice™), one with 30 ml of 5% permethrin (Mallinckrodt Veterinary) and one was non-treated and served as a control. Volumes were measured with a graduated ladle provided with the products. Subsequently the ladle was calibrated against a laboratory grade graduated cylinder and was found to read 10% less volume than indicated. Thus animals in the 30 ml and 150 ml groups actually received 27 and 135 ml, respectively. Permethrin was applied along the dorsal midline of animals in the treated groups. Animals were to be re-treated at 14 d intervals (following weekly fly counts) if control on either of the treated herds fell below 90%.

At approximately weekly intervals, the number of horn flies per one side and face flies per face were counted on ten randomly selected animals in each herd. Counts were made on the same day between 11:30 and 14:30 h on the three herds. Air temperature, wind speed and percent cloud cover were recorded during each sampling interval and counts were not performed on unseasonably cool days or when high winds (>25 kph) or rain were present. Differences in the number of horn flies and face flies on animals in the different herds during each sampling interval were determined using analysis of variance. Percent reduction of horn fly and face fly populations was determined for each weekly count and over the entire season.

Hair samples (7 X 7 cm or 49 cm^2) from the back, side and belly of three randomly selected animals from each herd were collected 7, 14 and 42 d after the start of the trial. Samples were wrapped in aluminum foil, sealed inside ziplock plastic bags and held at 5• C until analysed for permethrin residues by the Ontario Provincial Pesticide Residue Laboratory in Guelph, Ontario. The analytical procedure has been described by Braun & Stanek (1982).

RESULTS: Both permethrin treatments provided 99% (season mean) reduction in horn flies over 62 d post-treatment (Table 1). There was no significant difference in reduction between the two permethrin dosages every week of the study (ANOVA; *P*• 0.05). There was no indication that control was subsiding at the completion of the study period. The 1% and 5% permethrin treatments provided 43.8% and 55.2% reduction (season mean) of face flies, respectively. Permethrin residues from hair samples are summarized in Table 3. Residues were most concentrated in samples taken from the back line and least concentrated in samples taken from the belly. There was no significant difference in residue concentrations in hair samples taken from each permethrin treatment, all sections and dates combined. Residues decreased with each successive sampling date.

CONCLUSIONS: Both the 1% and 5% formulations applied at the rate of 150 or 30 ml of product, respectively, provided excellent horn fly control. The volume of product applied did not affect control. Both formulations did not provide satisfactory control of face flies. There were no ill effects to animals noted.

Table 1. Mean (± SD) number of horn flies on 10 randomly selected dairy cattle and percent reduction following application of 150 ml of 1% permethrin and 30 ml of 5% permethrin.

Date	Days post-treatment	Treatment		
		Non-treated	1% permethrin	5 % permethrin
July 13	1	24.1 ± 12.5a[1]	0.1 ± 0.3b (99.6)[2]	0 ± 0b (100)
19	7	46.0 ± 18.1a	0.2 ± 0.4b (99.6)	0 ± 0b (100)
25	13	45.3 ± 41.0a	0.3 ± 0.7b (99.3)	0.3 ± 0.5b (99.3)
Aug. 1	20	65.6 ± 55.7a	0.9 ± 0.7b (98.6)	0.3 ± 0.5b (99.5)
8	27	47.0 ± 48.1a	0.6 ± 1.3b (98.7)	0.6 ± 1.3b (98.7)
15	34	41.0 ± 40.4a	1.5 ± 1.7b (96.7)	0.4 ± 0.5b (99.0)
22	41	40.2 ± 17.7a	0.9 ± 0.7b (97.8)	0.7 ± 0.8b (98.2)
29	48	57.5 ± 37.1a	0.5 ± 1.1b (99.1)	0.4 ± 1.0b (99.3)
Sept. 5	55	51.0 ± 20.8a	0.3 ± 0.5b (99.4)	0.9 ± 0.9b (98.2)
12	62	29.5 ± 15.6a	0.1 ± 0.3b (99.7)	0.1 ± 0.3b (99.7)
Season Mean Percent Reduction:		---	98.9	99.2

[1] Means within rows followed by the same letter are not significantly different (ANOVA; *P*• 0.05).

[2] Percent reduction calculated as: [(No. of flies on non-treated animals - No. of flies on treated animals)/No. of flies on non-treated animals)] X 100%.

Table 2. Mean (± SD) number of face flies on 10 randomly selected dairy cattle and percent reduction following application of 150 ml of 1% permethrin and 30 ml of 5% permethrin.

Date	Days post-treatment	Treatment		
		Non-treated	1% permethrin	5 % permethrin
July 13	1	5.1 ± 6.0[1]a	1.4 ± 1.2b (90.7)[2]	0.2 ± 0.4b (98.7)
19	7	10.2 ± 3.8a	0.8 ± 1.9b (92.1)	0.4 ± 0.7b (96.1)
25	13	5.5 ± 2.5a	6.3 ± 2.9a (0.0)	3.9 ± 2.0a (29.1)
Aug. 1	20	17.8 ± 7.9ab	18.3 ± 8.6a (0.0)	9.6 ± 4.7b (47.5)
8	27	7.5 ± 4.7a	8.8 ± 6.3a (0.0)	11.0 ± 8.0a (0.0)
15	34	15.0 ± 6.1a	11.0 ± 5.2a (26.7)	3.0 ± 1.9b (80.0)
22	41	14.2 ± 8.2a	3.0 ± 3.5b (78.9)	8.0 ± 4.4ab (43.7)
29	48	20.6 ± 10.2a	5.3 ± 2.9b (74.3)	12.6 ± 6.9ab (38.8)
Sept. 5	55	12.2 ± 4.8a	7.2 ± 4.2ab (41.0)	7.0 ± 3.9b (42.6)
12	62	12.4 ± 8.1a	11.2 ± 6.9a (9.7)	2.7 ± 1.8b (78.2)
Season Mean Percent Reduction:		---	41.3	55.5

---

[1] Means within rows followed by the same letter are not significantly different (ANOVA; *P*• 0.05).

[2] Percent reduction calculated as: [(No. of flies on non-treated animals - No. of flies on treated animals)/No. of flies on non-treated animals)] X 100%. If the mean number of flies was greater on a treated herd than on the non-treated herd on a given date, reduction was considered 0.0%.

Table 3. Permethrin residues[1] (μg/g) in hair from dairy cattle[2] treated with 1% and 5% permethrin pour-on products and non-treated animals 7, 14 and 42 d post-treatment.

		Days Post-treatment		
		7	14	42
Non-treated	Back	ND[3]	ND	ND
	Side	ND	ND	ND
	Belly	ND	ND	ND
1% Permethrin	Back	243.3 ± 119.3	26.3 ± 10.6	0.2 ± 0.2
	Side	116.7 ± 158.8	1.8 ± 0.2	0.1 ± 0.1
	Belly	8.8 ± 5.2	1.7 ± 0.6	0.02 ± 0.03
5% Permethrin	Back	420.0 ± 313.2	76.7 ± 58.6	4.9 ± 7.0
	Side	32.0 ± 27.7	7.5 ± 8.4	0.5 ± 0.5
	Belly	9.9 ± 6.2	3.1 ± 4.6	0.09 ± 0.01

[1] Combined residues for all sections and dates for each permethrin treatment were not significantly different (ANOVA; *P*• 0.05).

[2] Based on three animals per treatment on each sampling date.

[3] Not detected (detection limit 0.05 μg/g).

#076 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86100101

HOST: Horse, various breeds

PEST: Black fly, *Simulium vittatum* Zetterstedt
Face fly, *Musca autumnalis* (DeGeer)
Horse flies, *Tabanus Linnaeus* spp.
Deer flies, *Chrysops* Meigen spp.

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TITLE: CONTROL OF NUISANCE FLIES ON HORSES USING A 1% PERMETHRIN OIL-BASED FORMULATION

MATERIALS: 1% permethrin, oil-based pour-on, C/0 Wilson's Laboratories Inc., 5300, Harvester Road, Burlington, Ontario L7L 5N5

METHODS: Two separate groups of horses were used in this trial. Herds were of mixed breeds including quarter horses, thoroughbreds, Newfoundland ponies and a mammoth mule. Both herds were located on the same farm on pastures separated by approximately 500 m. Treatment was applied with a hand mister at 2 d intervals beginning during the first week of June. All horses in one of the herds were treated on the head, ears, neck, and groin with 10 ml total of an oil-based 1% permethrin formulation. Treatment to the ears consisted of one squirt of the hand mister onto the fingers of one hand wearing a latex glove, which was then wiped into the ear (one squirt = 0.9 ml, one squirt per ear). After four treatments it became necessary to reduce the frequency of treatment to once every 4 d due to excessive oily residue on the necks of treated animals. Another group of nine animals were not treated and served as controls. Treatments were terminated in mid June when the black fly population fell below detectable levels on the non-treated herd. Treatments resumed when a second black fly cohort appeared the second week of July. Observations took place at approximately 3-4 d intervals from early June to late July, during warm sunny days between 9:30 a.m. and 4:00 p.m. on the same day. Four pre-treatment counts were performed on June 5 and were designated as counts: June 5-1, 5-2, 5-3 and 5-4. Treatments made on June 5 and July 14 were done after pre-treatment observations on the same date. Observations were made from within pastures with observers standing 5-10 m from animals. Defensive behaviour was determined using a single two min observation per horse. Activities such as skin quivers, tail swishes, head/ear shakes, and leg kicks were recorded. During the same period, the number of black flies, face flies and horse/deer flies per horse were counted. During the first cohort of black flies the number of black flies was estimated by counting the approximate number flying around or landing on the head of each animal. For the second cohort, which was smaller, it was necessary to count the number of black flies feeding inside both ears and then sum the two numbers. Face flies were counted as the number of face flies per face throughout the study. Horse and deer flies (Tabanids) were counted as the number of flies per side throughout the study. Horse fly and deer fly data were combined for analysis. During the second black fly cohort, the number of blood flecks and degree of scabbing inside ears was recorded. A rated scale was used with the degree of blood flecks/scabbing equal to 0 (none), 1 (low), 2 (med), or 3 (high). A rating of none corresponded to smooth inner ears with no blood flecks (fresh bites) or scabbing. A rating of low, medium and high corresponded to 1-5, 5-25 and >25 blood flecks/scabs/ear, respectively.

Differences in the mean behavioural index each week was determined using analysis of variance and Scheffe's comparison of means test. Differences in the number of black flies, face flies and horse/deer flies were also determined using analysis of variance and Scheffe's comparison of means. Differences in the number of blood flecks/scabbing during the second black fly cohort was determined non-parametrically using the Kruskal-Wallis analysis of variance and the Mann-Witney-Wilcoxon comparison of means.

Black flies were collected and identified using the keys of Davies *et al* (1962). Other less frequently observed fly species were also noted. Temperature, wind speed and percent cloud cover were recorded on each sampling day.

RESULTS: The mean behavioural index was not significantly different (P• 0.05) between the treated and non-treated herds during the first cohort of black flies (Table 1). The mean behavioural index was significantly lower on the treated herd during the second black fly cohort on four of five dates of observation. The mean number of black flies swarming/landing was not reduced 2 d after initial treatment (Table 2). After the second treatment, however, and throughout the June 10-20 treatment period, black flies were reduced an average of 99.1% on the treated herd (Table 2). Black flies inside ears were reduced by an average of 92.7% during the July 18-31 treatment period compared to the non-treated herd. The number of face flies were significantly lower (P• 0.05) on the treated herd on 4 of 14 post-treatment observation dates. Mean reduction of face flies was 36.7% during treatment periods. The mean number of horse/deer flies was not significantly different (P• 0.05) between the two herds throughout the treatment periods. The mean blood fleck index was significantly lower (P• 0.05) on 3 of 5 observation dates during the July 14-31 treatment period (Table 3). Mean percent reduction in blood fleck index throughout the treatment period was 91.7%.

Black flies were identified as *Simulium vittatum* Zetterstedt. Other fly pests, observed in lower numbers, included mosquitoes in early June and bot flies and stable flies in mid- to late July. Throughout the study period wind ranged from 0-15 kph and temperature ranged from 23-32•C.

There were no ill effects observed as a result of treatment. When treated at a frequency of every second day, however, necks and manes of horses became excessively oily. This effect was not injurious to treated animals but was aesthetically undesirable.

CONCLUSIONS: In southern Ontario there are numerous fly pests which attack horses and elicit various behavioural responses such as those observed in this study. Although black flies were reduced by >92% on the herd treated with 1% permethrin, behavioural response to other fly species was pronounced, especially from horse/deer flies. During the second black fly cohort horse/deer flies were less numerous and behavioural responses were reduced significantly on most observation dates as a result of treatment.

The treatment itself was simple but became progressively more difficult throughout the study period as horses became familiar with the treatment procedure. Treatment inside the ears was particularly disliked by the animals, sometimes resulting in loss of product and incomplete treatments. The product, as formulated, was too viscous to form a mist, but rather, formed a stream leaving oily streaks on the hair. Black flies were only observed feeding inside ears, whereas, >80% of treatment was applied elsewhere. Perhaps treatment should be confined to the ears of animals, provided they will accept treatment on a regular basis. Treatment every 4 d appeared to be as effective as treatment every 2 d.

Table 1. Mean behavioural index[1] for horses treated with 1% permethrin and non-treated horses.

Treatment Regime	Date	Non-Treated	Treated
Pre-treatment	June 5 - 1	13.8 ± 8.2a[2]	19.9 ± 6.7a
	5 - 2	16.6 ± 11.9a	19.7 ± 9.2a
	5 - 3	12.8 ± 10.9a	23.9 ± 8.9b
	5 - 4	17.7 ± 12.1a	19.3 ± 8.2a
Post-treatment[3]	7	17.8 ± 6.4a	11.1 ± 5.3b
	10	14.6 ± 6.4a	14.4 ± 8.4a
	13	10.8 ± 8.5a	10.4 ± 6.4a
	14	22.0 ± 12.2a	18.2 ± 10.9a
	16	31.1 ± 16.1a	24.3 ± 9.4a
	19	23.1 ± 13.9a	19.0 ± 13.2a
	20	24.3 ± 12.3a	23.4 ± 12.1a
	22	22.9 ± 13.6a	21.2 ± 7.7a
	29	16.0 ± 8.5a	19.3 ± 11.3a
Pre-treatment	July 11	19.4 ± 7.2a	19.6 ± 7.4a
	14	17.1 ± 11.1a	23.1 ± 10.1a
Post-treatment	18	10.0 ± 7.2a	14.0 ± 8.9a
	22	39.0 ± 11.7a	12.7 ± 2.9b
	26	23.6 ± 11.5a	13.4 ± 3.2b
	27	32.3 ± 8.8a	15.7 ± 7.6b
	31	30.1 ± 11.0a	17.3 ± 3.5b

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[1] Calculated as the sum of the number of skin quivers, head shakes, tail swishes, and leg kicks observed over a 2 min period per animal ± one standard deviation.

[2] Values followed by the same letter in the same row are not significantly different (P • 0.05).

[3] Treatment dates: June 5, 8, 10, 12, 16 and July 14, 18, 22, 26.

Table 2. Mean number[1] of black flies on horses treated with 1% permethrin and non-treated horses.

Treatment Regime	Date	Non-Treated	Treated
Pre-treatment	June 5 - 1	11.7 ± 8.3a[2]	17.2 ± 13.0a
	5 - 2	9.4 ± 6.8a	17.8 ± 12.3a
	5 - 3	9.4 ± 5.3a	21.1 ± 9.6b
	5 - 4	7.8 ± 5.1a	20.6 ± 8.5b
Post-treatment[3]	7	13.3 ± 10.6a	10.6 ± 6.8a
	10	0.3 ± 0.5a	0.0 ± 0.0a
	13	0.6 ± 1.3a	0.0 ± 0.0a
	14	1.2 ± 1.5a	0.0 ± 0.0b
	16	6.6 ± 4.3a	0.2 ± 0.4b
	19	0.3 ± 0.5a	0.0 ± 0.0a
	20	0.1 ± 0.3a	0.0 ± 0.0a
	22	0.2 ± 0.7a	0.0 ± 0.0a
	29	0.0 ± 0.0a	0.0 ± 0.0a
Pre-treatment	July 11	1.3 ± 1.0a	0.8 ± 2.0a
	14	1.4 ± 1.1a	1.7 ± 1.5a
Post-treatment	18	0.0 ± 0.0a	0.0 ± 0.0a
	22	2.0 ± 1.4a	0.2 ± 0.4b
	26	0.8 ± 1.2a	0.2 ± 0.4a
	27	2.3 ± 2.5a	0.0 ± 0.0b
	31	0.4 ± 0.5a	0.0 ± 0.0a

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[1] Calculated as the estimated number of black flies in flight around the head of each animal on each sampling date from June 5-29 or the total number of black flies in both ears of each animal from July 11-31, ± one standard deviation.

[2] Values followed by the same letter in the same row are not significantly different (P • 0.05).

[3] Treatment dates: June 5, 8, 10, 12, 16 and July 14, 18, 22, 26.

Table 3. Mean blood fleck index calculated from observations of horse ears in a herd treated with 1% permethrin and a non-treated herd.

		Blood Fleck Index[1]	
Treatment Regime	Date	Non-Treated	Treated
Pre-Treatment	July 11	1.1 ± 0.7a[2]	1.0 ± 0.7a
	14	1.3 ± 0.9a	1.3 ± 1.0a
Post-Treatment[3]	18	1.5 ± 0.8a	0.0 ± 0.0b
	22	1.6 ± 0.5a	0.2 ± 0.4b
	26	0.5 ± 0.5a	0.2 ± 0.4a
	27	0.7 ± 0.6a	0.0 ± 0.0b
	31	0.5 ± 0.5a	0.0 ± 0.0a

[1] Based on scaled rating with degree of blood flecks/scabbing equal to 0 (none), 1 (low), 2 (med), or 3 (high), ±one standard deviation.

[2] Values followed by the same letter in the same row are not significantly different (P • 0.05).

[3] Treatment dates: July 14, 18, 22, 26.

ENTOMOLOGY / ENTOMOLGIE

ORNAMENTAL AND GREENHOUSE / PLANTES ORNEMENTALES ET DE SERRE

Section Editor / Réviseur du section : B. Broadbent

#077 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Turfgrass, cv. Kentucky Bluegrass

PEST: Japanese beetle, *Popillia japonica* Newman

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TITLE: FIELD EVALUATION OF BAY-NTN-33893 AND DYLOX FORMULATIONS FOR JAPANESE BEETLE CONTROL ON TURF

MATERIALS: BAY-NTN-33893 75% WP (imidacloprid); BAY-NTN-33893 0.5% G (imidacloprid); BAY-NTN-33893 240 g/L F (imidacloprid); DYLOX 80 SP (trichlorfon); DYLOX 6.2G (trichlorfon); DYLOX 420 L (trichlorfon);
DURSBAN TURF 480 g/L (chlorpyrifos)

METHODS: The trial was conducted on a baseball playing field in Kilbride, Ontario in August 1995. Soil information at the test site was as follows: soil texture: fine sandy loam, 55.6% sand, 33.0% silt, 11.4% clay, 4.4% OM and pH = 6.7. Treatments were assigned to 2 x 4 m plots, replicated 4 times and arranged according to a randomized complete block design. The liquid formulations were mixed in 500 L/ha of water and applied with a two metre CO_2-powered hand boom sprayer equipped with 4 flat fan TJ 8004 nozzles at a pressure of 241 kPa. The granular formulations were applied evenly to individual plots using a bottle with a fertilizer banding attachment. All treatments were applied on August 25. Japanese beetle larvae were in the first to second instar and present at an average of 67%/0.25 m^2 at the time of treatment. Turf was healthy and cut at 5 to 8 cm with a thatch layer of approximately 0.5 cm. All treatments were watered in with 1.0 cm of water within 4 h of the application. Weather conditions at application: Air - 22•C, RH - 54%. The nontreated, DYLOX, and DURSBAN treatments were assessed at 21 and 33 d after treatment (DAT). BAY-NTN-33893 treatments were assessed at 33 d after treatment. At 21 DAT a 0.25 m^2 area of turf was removed. The turf, and soil below the turf were inspected and the number of beetle larvae was recorded. At 33 DAT the treatments were assessed by removing the turf, thatch layer and 10 cm of soil from five locations per plot with a golf course cup changer. The number of larvae per total area (0.04 m^2) was recorded. Each assessment has been reported as the number of larvae per 0.25 m^2. Data were transformed using a square root transformation and analysed using an analysis of variance and Duncan's Multiple Range Test at the 5% significance level. Visual phytotoxicity ratings (percent injury) were made at 21 DAT.

RESULTS: There was no visual phytotoxicity observed in any of the treatments tested. Efficacy results are shown in Table 1.

CONCLUSIONS: All DYLOX formulations significantly reduced the number of Japanese beetle larvae per 0.25 m^2 at 21 and 33 DAT compared to the nontreated control and the registered standard treatment DURSBAN TURF. There was no significant difference among DYLOX formulations.

All BAY-NTN-33893 formulations significantly reduced the number of Japanese beetle larvae per 0.25 m^2 at 33 DAT compared to the untreated control and the registered standard treatment DURSBAN TURF. There was no significant difference among BAY-NTN-33893 formulations.

All treatments except DURSBAN TURF provided very good control of a severe Japanese beetle infestation.

Table 1. Mean number of Japanese beetle larvae per 0.25 m^2 of turf at 21 and 33 days after treatment (DAT), 1995.

Treatment	Formulation	Rate (kg ai/ha)	Larvae no./0.25m^2 21 DAT	Larvae no./0.25m^2 33 DAT
1. Nontreated	------	----	60.7 a*	73.5 a
2. BAY-NTN-33893	75 WP	0.335	-----**	0.0 c
3. BAY-NTN-33893	0.5 G	0.335	-----	10.4 bc
4. BAY-NTN-33893	240 F	0.335	-----	6.1 bc
5. DYLOX	6.2 G	9.0	3.2 b	14.5 b
6. DYLOX	80 SP	9.0	14.9 b	15.9 b
7. DYLOX	420 F	9.0	10.9 b	5.1 bc
8. DURSBAN TURF	480 EC	2.16	72.6 a	91.7 a

* Means followed by the same letter are not significantly different (P = 0.05, Duncan's MRT).

** BAY-NTN-33893 formulations were assessed at 33 DAT only.

ENTOMOLOGY / ENTOMOLGIE

BASIC STUDIES / ÉTUDES DE BASE

Section Editor / Réviseur de section : S.A. Hilton

#078 REPORT NUMBER / NUMÉRO DU RAPPORT

BASE DE DONNEES DES ETUDES: 335-1261-9207

CULTURE: Crucifères, pomme de terre, petits fruits, arbres fruitiers

RAVAGEURS: Pyéride du choux, *Artogeia rapae* (L.)
Carpocapse de la pomme, *Laspeyresia pomonella* (L.)
Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say)
Punaise terne, *Lygus lineolaris* (P. de B.)
Livrée des forêts, *Malacosoma distria* (L.)
Fausse-teigne des crucifères, *Plutella xylostella* (L.)
Vanesse de l'artichaut, *Vanessa cardui* (L.)

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TITRE: ISOLEMENT DE BACTERIES INSECTICIDES *Bacillus thuringiensis* A PARTIR D'INSECTES MORTS

MÉTHODES: Un programme de dépistage de nouvelles souches de *Bacillus thuringiensis* a été mis sur pied au printemps 1993. On a demandé à plus de 200 intervenants du secteur agricole de nous faire parvenir des insectes morts de causes naturelles. Les insectes pouvaient provenir de toutes les cultures rencontrées par les intervenants: Ces insectes devaient toutefois avoir été récoltés dans un endroit où il n'y avait pas eu d'arrosages avec des insecticides chimiques. Ces insectes nous étaient acheminés par courrier normal, à température normale dans de petits tubes ou bocaux fermés de façon hermétique.

À la réception, l'insecte était broyé dans un tampon phosphate à pH 7.0 et soumis à un choc thermique de 80•C pendant 20 min de façon à sélectionner les micro-organismes présents sous forme de spores. Des dilutions en séries de l'homogénat étaient ensuite étalées sur plats de Petri contenant du milieu T3. Le milieu T3 permet la croissance et la sporulation de *B. thuringiensis*. Les plats de Petri furent incubés à 30•C pendant 48 h. Les colonies obtenues furent analysées au microscope à contraste de phase pour la présence de spores, typiques du genre *Bacillus*, et d'inclusions para-sporales typiques de l'espèce *thuringiensis*.

RÉSULTATS: Des souches de *B. thuringiensis* ont été isolées à répétition à partir des insectes indiqués au tableau 1.

CONCLUSIONS: Ces souches bactériennes ont fait l'objet d'études plus approfondies de façon à déterminer si nous étions en présence de souches connues ou de nouvelles souches. Ainsi, les profils protéiques de cultures sporulées ont été déterminés par électrophorèse sur gels de polyacrylamide en présence de sodium dodecyl sulphate et comparés à ceux de souches connues. Les profils d'ADN plasmidiques ont également été analysés par électrophorèse sur gels d'agarose et comparées à ceux de souches connus. Ceci nous à permis de montrer que certaines de nos souches de *Bacillus thuringiensis* isolées à partir d'insectes étaient nouvelles. La caractérisation par sérotypie est en cours da façon à confirmer le caractère unique de ces souches bactériennes. Des collaborations ont été établies récemment avec des entomologistes pour la poursuite de bio-essais de façon à confirmer ou infirmer leur caractère pathogène.

Tableau 1. Liste des insectes à partir desquels *Bacillus thuringiensis* a été isolé.

Pyéride du choux	*Artogeia rapae* (L.)
Carpocapse de la pomme	*Laspeyresia pomonella* (L.)
Doryphore de la pomme de terre	*Leptinotarsa decemlineata* (Say)
Punaise terne	*Lygus lineolaris* (P. de B.)
Livrée des forêts	*Malacosoma distria* (L.)
Fausse-teigne des crucifères	*Plutella xylostella* (L.)
Vanesse de l'artichaut	*Vanessa cardui* (L.)

#079 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 280-1452-9505

CROP: Horticultural crops

PEST: Insects of horticultural crops

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TITLE: EFFECT OF SELECTED INSECTICIDES ON SOIL DENITRIFICATION AND BIOMASS-C

MATERIALS: Technical (>87% purity) amitraz, cyfluthrin, imidacloprid, tebupirimphos, Aztec (a mixture of 19 tebupirimphos: 1 cyfluthrin).

METHODS: Insecticides were applied to the soil at a rate of 10 µg a.i/g of sandy soil. Twenty

gram portions of soil samples were weighed into 100 ml serum bottles containing KNO_3 equipped with gas tight butyl-rubber serum stoppers and sealed with an aluminum seal. The ability of the soil to denitrify nitrate and nitrite was studied by determining the amounts of N_2O-N evolved. Denitrification activity is reflected by gaseous nitrogen loss from NO_3-N in soil. Formation of N_2O was measured using a Varian model 3700 gas-chromatography equipped with dual thermal conductivity detectors and Porapak Q columns and a Varian model 9176 recorder. Corrections were made for N_2O solubility. Untreated controls were included with all tests. All results are expressed on an oven-dry basis and are means of triplicate determinations. The soil microbial biomass-C was determined by chloroform fumigation technique. Five grams of soil on an oven-dry basis were taken from each sample and placed in 120 ml glass vials. Half of the samples at 60% moisture-holding capacity were fumigated with ethanol-free $CHCl_3$ for 24 h and the other half were left unfumigated. After fumigation and removal of $CHCl_3$ and adjustment of the moisture content to 60% MHC, the soil was extracted with 20 ml 0.5M K_2SO_4 by shaking for 30 min at 110 RPM on an orbital shaker. Unfumigated soil was extracted similarly. Organic-C content of the K_2SO_4 extracts was determined by the dichromate titration with 0.5N ferrous ammonium sulphate using diphenylamine as an indicator.

RESULTS: A substantial increase in the ability to denitrify nitrate was observed in the flooded soil system. Soil gaseous nitrogen loss from NO_3-N into atmosphere occurs primarily as N_2O and N_2 as a result of reductive process (denitrification) in the presence of C_2H_2. This permits measurements of N_2O accumulation in soil. The effect of different treatments on denitrification in flooded soils over 1 and 2 week is presented in the table below. With the exception of cyfluthrin and imidacloprid after 2 week, all treatments inhibited denitrification throughout the experiment. No significant inhibitory effect on the amount of biomass-C was observed in any of the treatments during the 2 week incubation period.

CONCLUSION: The study of the effects of the insecticides on denitrification of nitrate in sandy soil indicated that with the exception of cyfluthrin and imidacloprid after 2 week, all treatments inhibited denitrification throughout the experiment. The recovery of denitrifying capacity of the experiment of the microbes after a 2 week incubation in the imidacloprid sample is due to reduction in toxicity of chemicals to the microbial population or recovery of activity of denitrified populations in soil. The failure to show correlation of the microbial populations in another study with biomass-C measurements suggests that it could be impractical for routine use of soil biomass-C by a fumigation-extraction to estimate soil biomass content.

Table 1. Effect of insecticides on denitrification and biomass-C in sandy soil.

Treatment	Denitrification µg N_2O-N/g		Biomass-C µg C/g soil	
	Incubation period (week)			
	1	2	1	2
Control	113	75	366	802
Amitraz	55*	52*	287	845
Cyfluthrin	77	68	261	771
Imidacloprid	68*	60	323	864
Tebupirimphos	61*	55*	305	814
Aztec	60*	56*	323	845

* Significantly different from control within each column at 5% level.

#080 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 280-1452-9505

CROP: Horticultural crops

PEST: Insects of horticultural crops

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TITLE: EFFECTS OF INSECTICIDES ON MICROBIAL ACTIVITIES IN NITRIFICATION AND SULFUR OXIDATION IN SANDY SOIL

MATERIALS: Technical (>87% purity) amitraz, cyfluthrin, imidacloprid, tebupirimphos, Aztec (a mixture of 19 tebupirimphos: 1 cyfluthrin).

METHODS: Insecticides were applied to the soil at a rate of 10 ug a.i/g of sandy soil. Samples were incubated at 28•C and 60% moisture-holding capacity. Soil nitrification was determined by phenol disulfonic acid method for nitrate at 410 nm in a spectrophotometer. The level of nitrite was determined by the diazotization method with sulphanilic acid, á-naphtylamine hydrochloride and sodium acetate buffer read at 525 nm. Sulfur oxidation was determined turbidimetrically in the soil extract at 429 nm for sulfate. Untreated controls were included with all tests. All results are expressed in terms of oven-dried soil, and are means of triplicate

determinations. Levels of significance were statistically analysed by analysis of variance.
RESULTS: A stimulatory effect on nitrification was observed with all insecticide treatments for 2 weeks. Sulfur oxidation was stimulatory for 4 weeks. No inhibitory effects were observed with any of the treatments.

CONCLUSION: None of the insecticide treatments inhibited soil nitrification or sulfur oxidation.

Table 1. Microbial activities after soil treatment.

Treatment	Nitrification µg(NO_2^- + NO_3^-)-N/g		Sulfur oxidation µg $SO_4^{=}$-S/g soil	
	Period of incubation (week)			
	1	2	4	8
Control	8.2	9.9	0.4	39.4
Amitraz	14.7*	18.1*	14.0*	26.4
Cyfluthrin	10.7*	18.9*	14.9*	27.6
Imidacloprid	13.8*	16.5*	16.6*	33.1
Tebupirimphos	11.4*	15.9*	26.1*	12.7
Aztec	9.1*	17.2*	22.9*	26.2

* Significantly different from the control within each column at the 5% level.

#081 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 280-1452-9505

CROP: Horticultural crops

PEST: Insects of horticultural crops

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TITLE: EFFECT OF SOME INSECTICIDES ON SOIL ENZYMES

MATERIALS: Technical (>87% purity) amitraz, cyfluthrin, imidacloprid, tebupirimphos, Aztec (a mixture of 19 tebupirimphos: 1 cyfluthrin)

METHODS: Insecticides were applied to the soil at a rate of 10 μg a.i/g of sandy soil. Samples were incubated at 28• C and 60% moisture-holding capacity. Soil dehydrogenase activity was measure by the formation of formazan (2,3,5-triphenyl-tetrazolium formazan) (TTF) after incubating the soil samples in a system containing 2,3,5-triphenyl tetrazolium chloride (TTC). Hydrolysis of p-nitrophenyl disodium orthophosphate in treated soil for 2 h demonstrated the effects of insecticides on phosphatase activity. Nitrogenase activity was determined by acetylene reducing capacity using gas chromatography.

RESULTS: None of the insecticides inhibited dehydrogenase activity. Formazan production was significantly greater with tebupirimphos and Aztec, than that of control for 2 week. Phosphatase activity, as indicated by the release of p-nitrophenol, is an index of the activity of microflora involved in soil organic phosphate decomposition. All treatments suppressed phosphatase activities after 1 week. However, none of the treatments inhibited the vigorous formation of p-nitrophenol after 2 week. The capacity of soil samples to reduce C_2H_2 to C_2H_4 provides evidence for potential N_2-fixation. With the exception of tebupirimphos, none of the insecticide treatments affected C_2H_2 reduction in soil relative to the control.

CONCLUSION: The insecticides selected for this study produced slight effects on soil microbial activities. The inhibitory effects were, however, short-lived. Apparently, the soil indigenous microbes can tolerate the chemicals used for the control of soil insects.

Table 1. Changes in soil enzymes as related to treatments of a sandy loam with insecticides.

Treatment	Dehydrogenase μg Formazan/g soil		Phosphatase 100μg-nitrophenol released/g soil/2h		Nitrogenase μM(C_2H_2• C_4H_4)/g	
	Period of incubation (week)					
	1	2	1	2	1	2
Control	31.6	49.6	24.3	18.5	17	15
Amitraz	29.2	32.4	15.2*	16.8	15	13
Cyfluthrin	52.0	53.9	14.6*	18.3	15	14
Imidacloprid	43.7	52.3	16.0*	21.5*	15	14
Tebupirimphos	55.4*	78.4*	14.9*	15.1	13*	13
Aztec	65.9*	77.3*	14.6*	15.5	16	14

* Significantly different from control at 5% level within each column.

#082 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 280-1452-9505

CROP: Horticultural crops

PEST: Insects of horticultural crops

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TITLE: EFFECTS OF SOME INSECTICIDES ON MICROORGANISMS IN SOIL

MATERIALS: Technical (>87% purity) amitraz, cyfluthrin, imidacloprid, tebupirimphos, Aztec (a mixture of 19 tebupirimphos: 1 cyfluthrin).

METHODS: The soil used was a sandy loam, a typical agricultural soil in southwestern Ontario. Ten micro grams active ingredient of insecticide were dissolved in 1 ml petroleum ether:acetone (1:1) mixture and incorporated with carrier sand. After the solvent had evaporated, the sand-insecticide mixture was incorporated with sandy loam by tumbling for 30 min. Changes in the soil microflora numbers were determined by soil dilution plate technique using sodium albuminate agar for bacteria and actinomycetes and rose-bengal streptomycin agar for fungi. Soil moisture was maintained at 60% moisture-holding capacity. Samples were incubated at 28• C for periods of 1 and 2 week after treatment. Analysis of variance was used in statistical analysis of results. All data are expressed on an oven-dry basis and are averages of triplicate determinations.

RESULTS: Bacterial numbers were reduced with most treatments after incubation for 1 week. Cyfluthrin stimulated bacterial number after 2 weeks. An inhibitory effect was observed after two weeks with treatment of imidacloprid on fungal numbers.

CONCLUSIONS: Bacterial populations were greater than that of control after 2 weeks. Result indicated that imidacloprid has a minor inhibitory effect on fungal populations after 2 weeks while cyfluthrin has a stimulatory effect on the bacterial population.

Table 1. Changes in colony counts as related to treatment of soil with insecticides.

Treatment	Bacteria ($X10^5$/g)		Fungi (10[illegible]/g)	
	Period of incubation (week)			
	1	2	1	2
Control	267	225	11	18
Amitraz	105*	251	12	21
Cyfluthrin	123*	426*	9	3
Imidacloprid	70*	239	15	7*
Tebupirimphos	79*	238	11	13
Aztec	47*	162	13	23

* Significantly different from control within each column at the 5% level.

#083 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 280-1252-9304

CROP: Potato

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: EFFECT OF MANAGEMENT PROGRAMS OVER THREE YEARS ON SUSCEPTIBILITY TO INSECTICIDES OF COLORADO POTATO BEETLE

MATERIALS: Technical: cypermethrin, azinphosmethyl, endosulfan, carbofuran, deltamethrin

METHODS: During each of 3 years, CPB were collected from potato fields on a "certified organic" mixed vegetable farm near St. Thomas, Ontario, and from a large commercial farm, practising conventional CPB management, near Alliston, Ontario. Susceptibility of the 2 CPB populations to insecticides was measured in direct contact bioassays using a Potter spray tower. A range of serial concentrations (up to 1% solution) was chosen to cause 0 to 100% mortality. A solvent CONTROL (19:1 acetone:olive oil) was included with each test. At each concentration, 2 replicates of 10 third-instar larvae or adults were sprayed with 5.0 ml of insecticide solution.

Treated insects were transferred to clean containers and fresh potato leaves provided for food. Mortality assessed after 18 h at 27•C and 65% R.H. LC50 values for toxicity of insecticides, estimated by means of log-probit graphs, were compared to appropriate LC50 values for a lab-reared susceptible strain, determined by probit analysis of regression lines.

RESULTS: In Year 1, CPB larvae from a "certified organic" farm demonstrated no (deltamethrin), very low (cypermethrin, azinphosmethyl) or moderate (endosulfan) insecticide resistance (Table 1). CPB adults collected from the conventional farm that same year exhibited moderate to extreme resistance to the same insecticides. By Year 3, resistance levels to all tested insecticides had increased to high levels in CPB from the "certified organic" farm. While resistance to deltamethrin also increased in CPB from the conventional farm, resistance to azinphosmethyl and endosulfan remained unchanged; resistance to cypermethrin decreased in Year 3 after doubling in Year 2.

CONCLUSIONS: Since no chemical insecticides were applied on the "certified organic" vegetable farm, increased insecticide resistance in collected CPB must be due to immigration from distant treated farms. The importance of coordinated, regional grower action in resistance management programs is thus emphasized. Repeated application of deltamethrin on the conventional farm rapidly increased resistance to this insecticide.

Table 1. Comparison of direct contact toxicity of insecticides to lab-reared susceptible (LAB-S) CPB and CPB collected from farms under organic (ORG) and conventional (CON) management.

Insecticide	Year	Source /Stage	LC50	Ratio*** /LAB-S	Source Stage	LC50	Ratio /LAB-S
cypermethrin	1	ORG-L*	.0035	X 3	CON-L	--****	--
	2		--	--		--	--
	3		.018	X 15		.038	X 32
	1	ORG-A**	.015	X 7	CON-A	.082	X 36
	2		.054	X 23		.18	X 78
	3		.11	X 48		.086	X 37
azinphosmethyl	1	ORG-L	.06	X 3	CON-L	--	--
	2		.07	X 3.5		--	--
	3		.24	X 12		--	--
	1	ORG-A	--	--	CON-A	>1.0	>X 15
	2		.4	X 6		>1.0	>X 15
	3		>1.0	>X 15		>1.0	>X 15
endosulfan	1	ORG-L	.1	X 19	CON-L	--	--
	2		.18	X 33		--	--
	3		--	--		--	--
	1	ORG-A	--	--	CON-A	>1.0	>X 60
	2		.4	X 25		>1.0	>X 60
	3		>1.0	>X 60		>1.0	>X 60
deltamethrin	1	ORG-L	.0001	X 1	CON-L	--	--
	2		--	--		--	--
	3		.0056	X 33		.013	X 76
	1	ORG-A	--	--	CON-A	.004	X 17
	2		.011	X 46		.0096	X 40
	3		.05	X 208		.026	X 108

* 3rd instar larvae

** adult

*** LC50 of field-collected CPB/LC50 lab-reared insecticide susceptible CPB at the comparable life stage

**** not determined

PLANT PATHOLOGY / PHYTOPATHOLOGIE

DISEASES OF FRUIT CROPS / MALADIES DES FRUITS

Section Editor / Réviseur de section : R.W. Delbridge

#084 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Apple, cv. Idared

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: FLUAZINAM 500F AIR BLAST APPLICATIONS FOR THE CONTROL OF APPLE SCAB, 1995

MATERIALS: BRAVO ULTREX (chlorothalonil 82.5%); FLUAZINAM 500F (500 g/L); NOVA 40 WP (myclobutanil 40%); POLYRAM 80 DF (metiram 80%)

METHODS: A commercial apple orchard in St. George, Ontario was used as the trial site. Treatments were assigned to two tree plots, replicated four times and arranged according to a randomized complete block design. Treatments 1-5 and 7 were applied beginning at green tip (05-May), and continued on a 7 to 10 d spray interval until the end of the primary scab period. The interval was then extended to 10-14 d for the remainder of the season. BRAVO ULTREX was applied at 120 g/100 L in a tank mix with NOVA after the first infection period (23-May). BRAVO ULTREX was then applied at 80 g/100 L for the remainder of the season on a 14 day interval. Applications were made with a commercial orchard sprayer at a sprayer pressure of 2760 kPa. The sprayer was calibrated to deliver 475 L/ha, 950 L/ha or 1900 L/ha (Table 1). Efficacy ratings were conducted on July 11 (leaves), and October 4 (fruit). Disease was assessed on 200 leaves or 100 fruit randomly chosen from the centre portion of each plot. Data are reported as the number and severity of scab on 200 leaves and 100 fruit. The number of diseased leaves/fruit include all leaves or fruit showing an apple scab symptom. Disease severity was assessed on a scale of 0-5 where 0 = no disease and 5 = 100% disease. The weight of the 100 fruit used for the ratings (including diseased fruit) was also recorded. Pest and beneficial mite species were monitored in each treatment. Data were analysed using an analysis of variance and Duncan's Multiple Range Test at the 5% significance level.

RESULTS: As presented in table. There was no visual phytotoxicity caused by any of the treatments tested. There were no significant numbers of pest or beneficial mites present in the test area during the study.

CONCLUSIONS: All fungicide treatments reduced the number of leaves and fruit infected with apple scab compared to the untreated control. Treatment 3 resulted in significantly more severe leaf scab with no increase in fruit scab compared to metiram. Treatment 5 resulted in a similar level of leaf scab to treatment 3, however, it had a significantly higher level of fruit scab compared to the other fungicide treatments. Treatment 3 was the only fungicide treatment to increase fruit weight compared to the untreated control.

Table 1. Apple scab and fruit weight assessments for Idared apples treated with fungicides, 1995.

Treatment	Rate (product/ 100 L H_2O)	Water Volume (L/ha)	Total** Number Appl.	Apple Scab count no/200 leaves	Apple Scab severity (0-5)	Apple Scab count no/100 fruit	Apple Scab severity (0-5)	Apple Weight kg/100
1 fluazinam	100 ml	1900	8	0.5 b*	0.5 c	0.0 c	0.0 c	12.6 ab
2 fluazinam	100 ml	950	8	2.3 b	0.8 bc	0.3 c	0.3 bc	13.0 ab
3 fluazinam	100 mL	475	8	4.5 b	1.3 b	0.0 c	0.0 c	13.6 a
4 fluazinam	200 ml	950	8	1.5 b	0.5 c	0.0 c	0.0 c	12.2 b
5 fluazinam	50 ml	950	8	4.3 b	1.0 bc	1.3 b	0.6 ab	12.5 ab
6 BRAVO ULTREX	120 g	1900	6	0.3 b	0.3 c	0.3 c	0.3 bc	12.5 ab
+ NOVA	340 g/ha							
BRAVO ULTREX	80 g	1900						
7 metiram	6.0 kg/ha	1900	8	0.3 b	0.3 c	0.0 c	0.0 c	11.9 b
8 untreated	-----	----	---	17.5 a	2.3 a	3.8 a	1.1 a	12.0 b

* Means followed by the same letter are not significantly different (P = 0.05, Duncan's MRT).

** Treatments 1-5 and 7 were applied on a 7 - 10 d spray interval from green tip until the end of the primary scab period. The interval was extended to 10 - 14 d for the remainder of the season.
BRAVO ULTREX (120 g/100 L) + NOVA was applied at the first infection period.
BRAVO ULTREX (80 g/100 L) was applied on a 14 d interval for the remainder of the season.

#085 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Apple, cv. Cortland

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: FLUAZINAM 500F APPLIED ON A PREVENTATIVE SCHEDULE FOR THE CONTROL OF APPLE SCAB, 1995

MATERIALS: FLUAZINAM 500F (500 g/L); POLYRAM 80 DF (metiram 80%)

METHODS: A commercial apple orchard in St. George, Ontario was used as the trial site. Treatments were assigned to two tree plots, replicated four times and arranged according to a randomized complete block design. Experimental treatments were applied beginning at green tip (05-May) and continued on a 7 - 10 d interval until the end of the primary scab period. The interval was then extended to 10 - 14 d for the remainder of the season. Applications to all treatments were made with a commercial orchard sprayer calibrated to deliver 1000 L/ha at a sprayer pressure of 2760 kPa. Efficacy ratings were conducted on July 12 (leaves), and September 23 (fruit). Disease was assessed on 200 leaves or 100 fruit randomly chosen from the centre portion of each plot. Data are reported as the number and severity of scab on 200 leaves and 100 fruit. The number of diseased leaves/fruit include all leaves or fruit showing an apple scab symptom. Disease severity is assessed on a scale of 0-5 where 0 = no disease and 5 = 100% disease. The weight of 100 fruit was also recorded. Pest and beneficial mite species were monitored in each treatment during the study. Data were analysed using an analysis of variance and Duncan's Multiple Range Test at the 5% significance level.

RESULTS: As presented in table. There was no visual phytotoxicity caused by any of the treatments tested. There were no significant numbers of pest or beneficial mites present in the test area during the study.

CONCLUSIONS: There was no significant difference in fruit disease or fruit weight levels between treated and untreated plots. Both fungicide treatments had significantly fewer leaves infected with leaf scab compared to the untreated control.

Table 1. Apple scab and fruit weight assessments for Cortland apples treated with fungicides, 1995.

Treatment	Form	Rate / 100 L H_2O	Apple Scab count no/200 leaves	Apple Scab severity (0-5)	Apple Scab count no/100 fruit	Apple Scab severity (0-5)	Apple Weight kg/100
1. fluazinam	500 F	100 ml **	0.0 b*	0.0 b	0.0 a	0.0 a	14.8 a
fluazinam	500 F	75 ml					
2. metiram	80% DF	6.0 kg/ha	0.5 b	0.3 b	0.3 a	0.3 a	15.3 a
3. untreated		---------	7.5 a	1.0 a	1.3 a	0.8 a	15.1 a

* Means followed by the same letter are not significantly different (P = 0.05, Duncan's MRT).

** Fluazinam (100 ml product/100 L) was applied on a 7 - 10 d interval from green tip to petal fall.
Fluazinam (75 ml product/100 L) was applied on a 10 - 14 d interval from petal fall to mid August.
Metiram was applied on a 7 - 10 day interval till petal fall followed by 10 - 14 d until mid August.

#086 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 91000658

CROP: Apple, cv. McIntosh

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: EVALUATION OF BAS-490 02 F AND RH-0611 ON A 10 DAY APPLICATION SCHEDULE FOR THE CONTROL OF APPLE SCAB, 1995

MATERIALS: BAS-490 02 F - 50 DF; NOVA 40 WP (myclobutanil); POLYRAM 80 DF (metiram); RH-0611 62.25 WP

METHODS: The trial was established in a 25-year old block of McIntosh trees on MM-106 and MM-111 rootstocks, spaced 1.83 m x 4.45 m, using a R.C.B. design with five-tree plots and four replicates. Applications were made with a diaphragm-pump, hand-gun system, operating at 1360 kPa, and were made on a spray to runoff basis. A full dilute rate of 3000 L/ha was assumed and treatment mixes were diluted on this basis. INFECTION PERIODS: 11/05 (light/moderate), 14/05 (moderate), 17/05 (moderate), 26/05 (light), 29/05 (moderate), 02/06 (severe), 11/06 (moderate). APPLICATIONS: Treatments were on a 10 d schedule for the period of primary scab infections. For the first two applications, through until bloom, BAS-490 and NOVA were applied on their own; for the third and fourth applications, made in the post-bloom period from fruit set to the end of primary infections, these products were tank mixed with POLYRAM. The preformulation of myclobutanil and mancozeb, RH-0611, was applied at the indicated dose rates on all four application dates. TREATMENT DATES: BAS-490 02 F and NOVA alone: 10/05 and 20/05, tank mixes with POLYRAM: 01/06 and 12/06. RH-0611: 10/05, 20/05, 01/06 and 12/06. ASSESSMENTS: All leaves on 40 clusters and 20 terminals/plot were examined for primary scab lesions; 150 fruit/plot were examined at harvest for scab lesions.

RESULTS: As presented in the table.

CONCLUSIONS: Under the moderate disease pressure resulting from the season's seven primary infections, all treatments provided highly significant control of fruit and leaf scab. With the near perfect disease control obtained with all treatments, it was not possible to detect a rate response with the BAS-490 product. All treatments based around this product provided results that were comparable to those found with the NOVA based commercial standard. All treatments received summer maintenance applications of metiram and captan using an AIR BLAST sprayer.

Table 1.

Treatment	Rate g a.i./ha	Appl. Dates	% Fruit Scab 12/09	% Terminal Leaf Scab - 25/07	% Cluster Leaf Scab - 25/07
1. Control	-	-	34.5a*	21.5a*	14.6a*
2. BAS-490	60	10/05, 20/05	0.3b	0.2b	0.0b
BAS-490 +	60	01/06, 12/06			
POLYRAM	2400				
3. BAS-490	90	10/05, 20/05	0.5b	0.1b	0.0b
BAS-490 +	90	01/06, 12/06			
POLYRAM	2400				
4. BAS-490	120	10/05, 20/05	0.5b	0.0b	0.0b
BAS-490 +	120	01/06, 12/06			
POLYRAM	2400				
5. NOVA	135	10/05, 20/05	1.3b	0.1b	0.0b
NOVA +	135	01/06, 12/06			
POLYRAM	2400				
6. RH-0611	1868	10/05, 20/05 01/06, 12/06	0.7b	0.5b	0.0b
7. RH-0611	2490	10/05, 20/05 01/06, 12/06	0.8b	0.3b	0.0b

* Means in same column, followed by same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test).

#087 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 91000658

CROP: Apple, cv. McIntosh

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: EVALUATION OF BAS-490 02 F FOR ERADICANT ACTIVITY AGAINST APPLE SCAB WITH POST-INFECTION "KICK-BACK" APPLICATIONS, 1995

MATERIALS: BAS-490 02 F-50 DF; NOVA 40 WP (myclobutanil); POLYRAM 80 DF (metiram); KUMULUS 80 DF (sulphur)

METHODS: The trial was established in a 25-year old block of McIntosh trees on MM-111 rootstocks, spaced 1.83 m x 4.45 m, using a R.C.B. design with five-tree plots and four replicates. Applications were made with a diaphragm-pump, hand-gun system, operating at 1360 kPa, and were made on a spray to runoff basis. A full dilute rate of 3000 L/ha was assumed and treatment mixes were diluted on this basis. TREATMENT SCHEDULE: The objective of the application scheduling was to evaluate the post-infection activity of BAS-490. To do this, treatments were focused against a single, major infection period; this infection period was chosen only after the foliage had fully leafed out. Treatments 3-6 were to be applied at different "kick-back" intervals following the chosen infection period. The intended intervals for treatments 3, 4 and 6 was 96 h, and was 120 h for treatment 5. Treatments 4-6 received a protectant application of KUMULUS sulphur at the half-inch green stage; this being done to provide some early season scab protection while waiting for the more advanced foliage development needed to test the post-infection activity of the treatments. Treatment 2, with only the Kumulus sulphur applied, and Treatment 3, with only the 96 h "kick-back" treatment of BAS-490 being applied, were included to verify that the early sulphur did not impact upon the eradicant treatments under evaluation. INFECTION INFORMATION AND MAINTENANCE FUNGICIDES: On May 14-15, with the trees at the late tight cluster stage, the infection against which the treatments would be timed occurred. Scab lesions, in their earliest visually detectable stages of development, were first seen May 30 on the 3rd and 4th leaf of both fruiting spurs and vegetative shoots. The appearance of lesions on this date suggested that an earlier, questionable wetting period on May 11-12 may have been responsible for these first lesions. In the 3-4 d after the initial detection, a series of new lesions were detected on the same leaves, indicating that the disease presence was likely due to the two infections and not just the one. Consideration had been given to timing the eradicant treatments against this wetting period, but calculations indicated that it would not likely result in anything beyond a very light infection. With the objective of the trial being to evaluate the eradicant treatments against a major infection, the decision was made to await the more significant infection being forecasted to begin May 14, and to remain aware of the possible effects of the May 11-12 wetting period. Beginning 13-14 d after the targeted infection period, a cover protection program was initiated over the entire trial area, under the assumption that these applications would provide protection from any subsequent infections, without affecting the primary disease development of the lesions from the May 14-15 infection. Using a commercial air-blast sprayer, Polyram DF was applied on May 27, June 3, June 10, June 22 and July 1 at 4.5 kg/ha, and Captan 80-W was applied July 17, July 24 and August 15 at 3.75 kg/ha. TARGETED INFECTION PERIOD: This moderate infection began on May 14 at 19:00 and continued through until 16:00 on May 15, a duration of 21 h at a mean temperature of 12.7•C. The earlier wetting period (later a suspected infection), began on May 11 at 14:00 and continued through until 09:00 on May 12, a duration of 19 h at a mean temperature of 10.9•C; during this wetting period there were three periods with no rainfall, varying between 1.5 to 3.0 h in length, when the relative humidity dropped to 85%. Prior to the eradicant applications, another moderate infection occurred; it began May 17 at 12:30 and ended May 18 at 04:30. APPLICATIONS: The 97 h post-infection applications were made on Treatments 3, 4 and 6 on May 18 at 20:00. The 121 h post-infection applications was made on Treatments 5 on May 19 at 20:00. The half-inch green application of KUMULUS sulphur over Treatments 2, 4, 5 and 6 were made on May 5 at 06:45. ASSESSMENTS: All leaves on 40 clusters and 20 terminals/plot were examined for primary scab lesions.

RESULTS: As presented in the table.

CONCLUSIONS: Overall, with three infections being dealt with instead of just one, BAS-490 provided excellent eradicant control of apple scab in all treatments. In relation to the principle infection being targeted, the control indicates that BAS-490 can be counted on for at least 121 h of "kick-back" activity. No significant differences were seen between the two application timings. The early application of sulphur did not appear to have any residual impact upon the results obtained with BAS-490 in Treatments 4 and 5, as the BAS-490 treatment applied without any early sulphur achieved comparable results. In all treatments, BAS-490 performed at levels that were at least equal to the NOVA commercial standard. Considering the May 11-12 infection, and the eventual timing of the treatment applications, it can be said that the excellent control levels discussed above, were obtained with early season post-infection applications that demonstrated pre-symptom "kick-back" activity at an interval as long as 198 h.

Table 1.

Treatment	Rate a.i./ha	Timing (h post-infection)	% Terminal Leaf 26/06	% Cluster Leaf 26/06
1. Control	-	-	12.2a*	16.4a*
2. KUMULUS sulphur	18 kg	N/A	9.0b	10.8b
3. BAS-490	120 g	97	1.6c	2.4c
4. KUMULUS sulphur	18 kg			
4. BAS-490	120 g	97	1.1c	1.5c
5. KUMULUS sulphur	18 kg			
5. BAS-490	120 g	121	2.0c	1.7c
6. KUMULUS sulphur	18 kg			
6. NOVA	135 g	97	1.6c	2.4c

* Means in same column, followed by same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test).

#088 REPORT NUMBER \ NUMÉRO DE RAPPORT

STUDY DATA BASE: 344-1261-7211

CROP: Apple, cv. Mutsu (Crispin)

PEST: Blister spot, *Pseudomonas syringae* pv. *papulans* (Rose 1917) Dhanvantari 1977

NAME AND AGENCY:
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TITLE: CONTROL OF BLISTER SPOT OF APPLES USING COPPER FUNGICIDES, 1995

MATERIALS: BORDEAUX (copper sulphate and lime), COPPER SPRAY WP (copper oxychloride), COPPER 53W (tribasic copper sulphate), KOCIDE 101 (cupric hydroxide), HYDRATED LIME.

METHODS: The trial was conducted in a commercial orchard of cv. Mutsu apples located near Harrow, Ontario. cv. Mutsu trees on M106 apple rootstock had been established in 1974 on a sandy loam soil site. Tree rows were spaced 6.7 m apart with a spacing between trees of 4.6 m. Treatments consisting of copper fungicides and hydrated lime (Table 1) were applied to single tree plots. Treated trees were separated by guard trees within the same row. A complete randomized block design with four blocks was used. Treatments were applied to run-off using a hand-held nozzle (1034 kPa). Copper fungicides were applied at two rates, the hydrated lime at one rate. Spraying was done only under conditions of light winds (10 km/h or less) on June 9, 19 and July 4. Prior to harvest, twenty fruit samples were removed from each of the treated trees and the blister spot lesions were counted. Fruit phytotoxicity (rating scale: 0-3) was also recorded. The disease counts along with the phytotoxicity ratings were subjected to statistical analysis using SAS.

RESULTS: No significant differences were detected among the fungicide treatments and rates. Both hydrated lime and the water check treatments had significantly higher levels of fruit spotting than the copper fungicides (Table 1). Some phytotoxicity was observed, notably when copper sulphate + lime (bordeaux) was used at the 2-6-1000 rate. Higher rates of fungicides resulted in greater levels of phytotoxicity, however they were not high.

CONCLUSIONS: Copper fungicides were effective in reducing fruit lesions caused by *P. syringae* pv. *papulans* on cv. Mutsu. Phytotoxicity would not appear to be a significant problem when using copper materials on growing tissues during the growing season.

Table 1. Comparison of disease incidence and phytotoxicity following the application of copper fungicides to cv. Mutsu trees at Harrow, ON in 1995.

Treatment	Rate (product/1000 L)	Lesions/apple*	Phytotoxicity**
Copper sulphate + lime	2.0 kg + 6 kg	0.2a***	1.26a
Copper 53W + lime	0.5 kg + 6 kg	0.2a	0.01bc
Kocide 101 + lime	1.0 kg + 6 kg	0.3a	0.04bc
Kocide 101 + lime	0.5 kg + 6 kg	0.3a	0.00c
Copper Spray WP + lime	1.0 kg + 6 kg	0.3a	0.05bc
Copper sulphate + lime	1.0 kg + 6 kg	0.4a	0.12b
Copper Spray WP + lime	0.5 kg + 6 kg	0.4a	0.00c
Copper 53W + lime	1.0 kg + 6 kg	1.0a	0.03bc
Water check	-	2.5b	0.00c
Hydrated lime	6 kg	4.8c	0.04bc

* Figures represent the means of four replications.

** Phytotoxic reaction was assessed on a scale of 0 to 3 where 0 = no reaction and 3 = high.

*** Figures with the same letter are not significantly different (P <0.05).

#089 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Blueberry, cv. Bluecrop

PEST: Fruit rot, *Botrytis cinerea* Pers. ex Fr.
Anthracnose, *Colletotrichum gloeosporioides* (Penz.) Sacc.

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TITLE: EFFICACY OF 9 FUNGICIDE TREATMENTS AGAINST FRUIT ROT OF BLUEBERRY, 1995

MATERIALS: BRAVO 500 F (chlorothalonil); BRAVO ULTREX 0825 SDG (chlorothalonil); Fluazinam 500 F; FUNGINEX 190 EC (triforine);
MAESTRO 75 DF (captan)

METHODS: The trial was located at a commercial blueberry farm in Abbotsford B.C. with a history of mummy berry. Plots consisting of one mature bush each were replicated 6 times in a randomized complete block design. Each bush was surrounded by an untreated bush on all four sides. Each treatment (Table 1) was applied according to specific plant growth stages, and then on a 7 - 14 d schedule as appropriate. Sprays were applied with a CO_2-back pack sprayer, single cone nozzle at 690 kPa and volume of 1000 L/ha. Berry samples were hand-picked on July 20, August 4 and August 28 for incubation experiments. Twenty berries from each treatment were randomly collected and placed separately in containers so they did not touch each other. The containers were sealed to maintain high humidity and held at room temperature. Berries were rated for fruit rot on July 27, August 11 and September 5.

RESULTS: As presented in table.

CONCLUSIONS: There were no significant differences in fruit rot development or yield due to variation within treatments. However, there was a strong trend indicating that early season applications of chlorothalonil plus pre-harvest captan would have a positive impact on yield and fruit rot management. There was no trend to suggest that triforine provided control of *Botrytis* or anthracnose. Anthracnose levels were three times higher when chlorothalonil was applied only three times during the spring versus six applications. BRAVO ULTREX showed a strong performance. There was no advantage to applying chlorothalonil had a high rate (5.0 kg a.i./ha) for the first application, as in timing "D".

Table 1. Post-harvest fruit rot development following various fungicide treatments during 1995.

Treatment	Rate ai/ha	Timing*	Percent** Botrytis	Percent** Anthracnose	Yield** kg/plot	Post-harvest** Yield kg/plot
BRAVO 500 + Captan	3.38 kg 1.8 kg	A	11.12	4.72	16.93	14.25
BRAVO ULTREX	3.6 kg	B	13.62	12.21	16.60	12.31
Captan	1.8 kg	C	17.5	13.33	15.68	10.85
BRAVO 500	5.0 kg/ 3.38 kg	D	18.33	10.55	15.64	11.12
BRAVO 500	3.38 kg	B	21.38	11.12	14.30	9.65
BRAVO 500 + Captan	3.38 kg 1.8 kg	E	15.28	15.83	14.27	9.83
Triforine	2.8 L	F	20.55	17.50	14.08	8.72
Triforine	2.8 L	G	22.21	16.12	13.98	8.62
Fluazinam	1 kg	F	17.78	7.78	13.88	10.33
Check	-	-	23.62	11.11	10.64	6.95

* Timing:

A Chlorothalonil applied at green tip (Mar 27), early pink bud (April 3), early petal fall (May 1), May 12, May 23, June 7. Captan applied at July 17, August 1 and August 25.

B Greentip (Mar 27), early pink bud (April 3), early petal fall (May 1), May 12, May 23,

	June 7.
C	April 24, May 1, May 8, May 15, May 23, August 1.
D	Same as "A" but the first spray was at 5.0 kg, and all the remaining were at 3.38 kg.
E	Chlorothalonil applied at greentip (Mar 27), early pink bud (April 3), early petal fall (May 1). Captan applied on August 1.
F	Middle pink bud (April 10), April 24, May 5, May 15.
G	Middle pink bud (April 10), April 24, May 5.
**	There was no significant difference between any treatments according to Student-Newman-Keuls test ($p<0.05$).

#090 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Blueberry, cv. Bluecrop

DISEASE: Mummy berry, *Monilinia vaccinii-corymbosi* (Reade Honey)

NAME AND AGENCY:

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TITLE: EFFICACY OF 7 FUNGICIDE TREATMENTS AGAINST PRIMARY AND SECONDARY MUMMY BERRY INFECTION OF BLUEBERRY, 1995

MATERIALS: BRAVO 500 F (chlorothalonil); BRAVO ULTREX 0825 SDG (chlorothalonil); Fluazinam 500 F; FUNGINEX 190 EC (triforine)

METHODS: The trial was located at a commercial blueberry farm in Abbotsford B.C. with a history of mummy berry. Plots consisting of one mature bush each were replicated 6 times in a randomized complete block design. Each bush was surrounded by an untreated bush on all four sides. Each treatment (Table 1) was applied according to specific plant growth stages until the end of bloom, to a maximum of 6 applications. One Funginex treatment was applied until the end of bloom, and the other Funginex spray stopped at mid-bloom. This was to determine if fruit russeting was caused by Funginex applications during late bloom. Sprays were applied with a CO_2-back pack sprayer, single cone nozzle at 690 kPa and volume of 1000 L/ha. Primary infections were counted on May 4-5, May 10-12 and May 25. Mummy berries were collected from bushes from June 29 to August 28. Harvesting occurred from July 20 - August 28.

RESULTS: As presented in table.

CONCLUSIONS: Triforine provided the best control of primary mummy berry infections, with chlorothalonil offering some protection and fluazinam offering poor protection. Unsprayed bushes had very high levels of infection but the unseasonably dry May (22.6 mm of rain over 4 d) likely reduced opportunities for secondary infections. Inoculum for secondary infections were produced on the adjacent untreated bushes which surrounded each plot. Triforine provided some control from secondary infections while chlorothalonil gave moderate control with 2 of the spray regimes. There was a very low level of berry russeting with no difference between the two application regimes.

Table 1. Comparison of total primary and secondary mummy berry infections following various fungicide treatments during 1995.

Treatment	Rate (ai/ha)	Timing*	Primary Infections per bush**	Secondary infections per bush**	Yield (kg) per plot**
Triforine	2.8 L	A	9.17 d	46.33 cd	13.98 a
Triforine	2.8 L	B	13.83 d	24.67 d	14.08 a
BRAVO 500	3.38 kg	C	105.33 c	114.00 abcd	16.93 a
BRAVO 500	5.0 kg/ 3.38 kg	D	122.00 bc	119.33 abc	15.64 a
BRAVO ULTREX	3.6 kg	E	126.83 bc	93.33 bcd	16.60 a
BRAVO 500	3.38 kg	E	139.83 bc	81.00 bcd	14.30 a
Fluazinam	1.0 kg	B	171.17 b	149.50 ab	13.88 a
Check	-	-	265.83 a	202.00 a	10.64 a

* Timing:
A Middle pink bud (April 10), April 24, May 5.
B Middle pink bud (April 10), April 24, May 5, May 15.
C Green tip (Mar 27), early pink bud (April 3), early petal fall May 1).
D Same as "A" but the first spray was at 5.0 kg, and all the remaining were at 3.38 kg.
E Greentip (Mar 27), early pink bud (April 3), early petal fall (May 1), May 12, May 23, June 7.
** Numbers followed by the same letter are not significantly different from each other according to Student-Newman-Keuls test ($p<0.05$).

#091 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Saskatoon, cv. Smoky

PEST: Entomosporium leaf and berry spot, *Entomosporium mespili* DC ex Duby

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TITLE: EFFICACY OF SIX FUNGICIDES AGAINST ENTOMOSPORIUM LEAF AND BERRY SPOT, 1995

MATERIALS: BRAVO 500 50% F (chlorothalonil); BENLATE 50% WP (benomyl); FUNGINEX 19% EC (triforine); KUMULUS 80% DF; NOVA 40% WP (myclobutanil); TILT 25% EC (propiconazole)

METHODS: Trials were conducted at commercial saskatoon (*Amelanchier alnifolia* Nutt.) orchards near Bowden, Seba Beach and Spruce Grove, Alberta. Treatments were applied to three trees in each of four replicates in a randomized complete block design. Adjoining plots within replicates were separated by an unsprayed tree. One row of untreated trees divided the experimental plot area from the production area of each orchard. Average plant heights at Bowden, Seba Beach and Spruce Grove were 2.9, 1.5 and 2.3 m, respectively. Plants at Bowden, Seba Beach and Spruce Grove were 16-17, five and nine-years-old, respectively. Treatments were applied with a hand-held CO_2-propelled sprayer equipped with a hollow-cone nozzle at a pressure of 275 kPa. All treatments were applied to run-off. Water served as the control. Fungicides were applied at several growth stages. Benlate, Bravo, Kumulus and Nova were applied at white-tip, petal-drop, green fruit to half-ripe stage, and pre-harvest. Final sprays were applied 14 d before harvest for Bravo and Nova, and 7 d for Benlate and Kumulus. Tilt was applied at white-tip, at petal drop and finally at the green-fruit to half-ripe stage; the last application was made 24-30 d before harvest. Funginex was applied at white tip and at petal drop at Seba Beach and Spruce Grove, with a pre-harvest interval of 30 d. Funginex was inadvertently sprayed a third time at Bowden at the green fruit stage, reducing the pre-harvest interval at this site to 24 d. Bravo was not applied at Spruce Grove due to space limitations.

Disease severity and incidence were evaluated at harvest, which occurred on July 29 at Spruce Grove and Seba Beach, and on August 4 at Bowden. Fruits from 30 racemes (10/tree) were evaluated from each plot using the 1 (0%) to 12 (100%) Horsfall-Barratt (H-B) disease severity index. Disease incidence was calculated as the percentage of fruits assigned a severity class rating of 2 or greater. Post-harvest disease severity on leaves was evaluated at Spruce Grove, Seba Beach and Bowden on August 14, August 24 and August 25, respectively. Disease severity was determined by examining five leaves on each of 10 fruit spurs or terminals per plant. The H-B scale was used to rate symptoms; disease incidence was calculated as indicated above for fruits.

RESULTS: Bravo substantially reduced disease severity on fruits (Table 1). Equivalent reductions in severity resulted when Benlate was applied at Seba Beach and Spruce Grove, but not at Bowden, the most severely-affected site. Tilt application significantly reduced disease severity at Bowden and Seba Beach, but not at Spruce Grove. With the exception of Funginex, all fungicides significantly reduced disease severity at Seba Beach and Spruce Grove in the post-harvest period (Table 2). Similar trends were observed at Bowden, except that Nova did not reduce disease severity. Benlate reduced disease incidence on fruit at Spruce Grove and Seba Beach, and post-harvest disease incidence at Spruce Grove. Bravo reduced disease incidence on fruit and post-harvest disease incidence at Seba Beach. Tilt reduced post-harvest disease incidence at Seba Beach.

CONCLUSIONS: Bravo, Benlate and Tilt provided the best control of Entomosporium leaf and berry spot at all test sites except Bowden, where Benlate was not effective. Kumulus gave intermediate results. Nova and Funginex failed to control the disease according to the criteria evaluated in this study.

Table 1. Effect of fungicide application on Entomosporium leaf and berry spot severity and incidence on fruit at harvest at three sites in Alberta.*

Treatment and rate (g ai/ha)	Bowden		Seba Beach		Spruce Grove	
	DS**	DI***	DS	DI	DS	DI
Bravo (1500)	3.0a	82.8a	1.5a	33.5a	---	---
Benlate (550)	5.4abc	92.5a	1.4a	29.5a	1.6a	34.4a
Tilt (190)	3.6ab	84.9a	1.6ab	44.6ab	2.1abc	54.4ab
Kumulus (600)	4.2abc	84.7a	2.2bc	64.9b	1.8ab	37.6ab
Nova (136)	5.8bc	96.0a	2.3c	64.0b	2.3abc	58.7ab
Funginex (570)	6.8c	96.9a	2.4c	67.6b	2.7c	71.8b
Control	6.5c	98.2a	2.4c	72.2b	2.5bc	65.1ab

* Figures are the means of 4 replications. Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test ($P<0.01$).

** Horsfall-Barratt disease severity index.

*** Arcsin-transformed percentage of fruits in Horsfall-Barratt severity classes 2-12. Back-transformed values are presented here.

Table 2. Effect of fungicide application on post-harvest disease severity and incidence of Entomosporium leaf and berry spot on leaves at three sites in Alberta.*

Treatment and rate (g ai/ha)	Bowden		Seba Beach		Spruce Grove	
	DS**	DI***	DS	DI	DS	DI
Bravo (1500)	4.2a	100.0a	3.3a	89.9a	---	---
Benlate (550)	8.2d	100.0a	3.3a	90.0a	1.6a	90.8a
Tilt (190)	5.9b	100.0a	5.1b	98.3b	2.7a	99.2b
Kumulus (600)	7.3c	100.0a	5.8bc	99.2b	4.7b	98.3b
Nova (136)	8.3de	100.0a	6.5c	99.2b	5.1b	100.0b
Funginex (570)	8.9de	100.0a	8.1d	100.0b	6.4c	100.0b
Control	9.0e	100.0a	8.0d	100.0b	6.7c	100.0b

* Figures are the means of 4 replications. Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test ($P<0.01$).

** Horsfall-Barratt disease severity index.

*** Arcsin-transformed percentage of leaf clusters in Horsfall-Barratt severity classes 2-12. Back-transformed means are presented here.

#092 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* cv. Smoky

PEST: Entomosporium leaf and berry spot, *Entomosporium mespili* DC ex Duby

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TITLE: EVALUATION OF BRAVO, FUNGINEX AND KUMULUS FOR PREVENTION OF ENTOMOSPORIUM LEAF AND BERRY SPOT ON SASKATOON PLANTS IN SASKATCHEWAN

MATERIALS: BRAVO 500 F (chlorothalonil); FUNGINEX 190 EC (triforine); KUMULUS 80 DF (sulphur)

METHODS: The trial was conducted in a saskatoon orchard near White City, Saskatchewan using 5-year old plants of the cultivar 'Smoky'. The trial consisted of six treatments, replicated three times in a randomized complete block design. Each plot consisted of three plants for an average plot size of 5 m2. There was a two plant buffer between each plot. Treatments were applied with a CO_2-pressurized backpack sprayer (R & D Sprayer Inc., Model D-201S) at a water volume of 1400 L/ha. Solutions were applied with an 8002 nozzle at 200 kPa evenly to each plant to the point at which the leaves and branches glistened. Fungicide rates and dates of application for each treatment are listed in Table 1. Maximum air temperatures were between 30 and 32• C on the following application dates: June 5, 15, 19 and July 10. Air temperature maximums were 13 and 19• C for application dates May 24 and June 30, respectively.

Phytotoxicity evaluations were conducted on July 19 by examining each plant and estimating the percentage of leaves that showed grey to blackened areas on the upper leaf surface. Two methods of evaluating disease incidence on the foliage were conducted on July 19 and August 3. An entire plant rating for disease severity was assigned using a scale of 0 - no disease present to 3 - plant severely infected. Disease incidence of the foliage was also assessed by visually estimating the percentage of leaves infected on the lower, mid and upper portions of each plant. Disease incidence on the fruit was determined by removing five clusters of berries from each of two portions (lower and middle) of each plant and recording the number of infected and non-infected berries. An arcsin transformation was performed on percent phytotoxicity, percent infected leaves and percent infected berries prior to analysis of variance with means separated by the Student-Newman-Keul test.

RESULTS: Both rates of KUMULUS caused significant phytotoxic damage compared to FUNGINEX and control treatments (Table 2). BRAVO exhibited some phytotoxic damage, but was not significantly greater than the control. There was a very low incidence of Entomosporium leaf and berry spot at the White City planting. On both evaluation dates, BRAVO was the only treatment to have significantly reduced overall disease rating compared to the control (Table 2). Leaf symptoms were greater on the lower portions of the plants on both evaluation dates (Table 3). Treatments had no significant effect on the percentage of leaves showing Entomosporium symptoms on the July 19 evaluation date. This lack of significant difference was probably due to a combination of low disease pressure, plot variability and the low number of replications. Although not significant, BRAVO had the lowest percentage of leaves showing Entomosporium symptoms on the July 19 evaluation date. On the August 3 evaluation date, again there was no significant difference between treatments in regards to the percentage of infected leaves in the lower portion of the plant. Although not statistically significant, BRAVO had the lowest incidence of Entomosporium leaf spot on the August 3 evaluation date. On the August 3 evaluation date, in the mid and upper portion of the plants, most fungicide treatments caused a significantly reduced incidence of leaf symptoms when compared to the control (Table 3). Disease symptoms on the berries was extremely low and there was no significant difference in the percentage of infected berries for any of the treatments tested (Table 3). Berry samples were taken from each treatment and residue analysis will be done at a later date.

CONCLUSIONS: BRAVO was the only fungicide to significantly reduce the overall incidence of leaf symptoms of Entomosporium on saskatoons. BRAVO treatments produced a white residue on the saskatoon leaves that may be of concern to U-pick operations for aesthetic reasons. Conclusions about the effectiveness of the fungicide treatments for preventing disease symptoms on the berries can not be made because of low disease pressure at the White City site in 1995. Both rates of KUMULUS caused significant phytotoxic damage to the foliage. This damage may have been exhibited because air temperatures exceeded 30•C on 3 of 5 dates when KUMULUS was applied.

Table 1. Fungicide rates and dates of application.

		Application dates					
Treatment	Rate kg ai/1400 L/ha	May 24	June 5	June 15	June 19	June 30	July 10
KUMULUS 1X	6.00	X	X	X		X	X
KUMULUS 2X	12.00	X	X	X		X	X
FUNGINEX early	0.57	X	X				
FUNGINEX late	0.57	X			X		
BRAVO	1.50	X	X	X		X	X
Control (water only)	-	X	X	X	X	X	X

May 24 - White tip stage of saskatoon.
June 5 - Completion of bloom of saskatoon plants.
June 19 - Two weeks after the completion of bloom of saskatoon plants.

Table 2. Effect of fungicides on phytotoxicity and Entomosporium leaf spot disease on overall plant foliage.

		Disease severity rating on foliage (0-3)	
Treatment*	Percent phytotoxicity**	July 19	August 3
KUMULUS 1X	18.3a	1.0a	0.7ab
KUMULUS 2X	21.7a	0.9a	0.7ab
FUNGINEX early	0.0 b	1.0a	1.2a
FUNGINEX late	0.0 b	0.8a	0.9ab
BRAVO	7.8ab	0.1 b	0.1 b
Control (water only)	0.0 b	1.1a	1.3a

* See Table 1 for rates and application dates of fungicides.

** Means in the same column followed by the same letter are not significantly different at the 5% level according to the Student Newman-Keul test.

Table 3. Effect of fungicide treatment on Entomosporium leaf and berry spot disease.

	Disease incidence on*							
	leaves %**					fruit %		
	July 19		August 3			July 19		
Treatment***	L	M	U	L	M	U	L	M
KUMULUS 1X	9.4a	1.2a	0.0a	6.2a	0.6 b	0.1 b	1.0a	1.0a
KUMULUS 2X	1.4a	0.2a	0.0a	2.8a	0.3 b	0.0 b	0.3a	0.0a
FUNGINEX	5.8a	0.6a	0.0a	11.1a	3.1ab	0.1 b	0.0a	0.0a
FUNGINEX late	0.9a	0.0a	0.0a	2.3a	0.3 b	0.1 b	3.7a	0.2a
BRAVO	0.1a	0.0a	0.0a	0.1a	0.0 b	0.0 b	0.0a	0.0a
Control (water only)	10.9a	2.9a	0.1a	16.6a	7.1a	1.6a	0.3a	0.0a

* Means in the same column followed by the same letter are not significantly different at the 5% level according to the Student Newman-Keul test.

** L = Lower portion of plant, M = Mid portion of plant, U = Upper portion of plant.

*** See Table 1 for rates and application dates of fungicides.

#093 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE:

CROP: Strawberry, cv. Honeoye

PEST: Angular leaf spot, *Xanthomonas fragariae* Kennedy & King

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TITLE: CONTROL OF ANGULAR LEAF SPOT OF STRAWBERRY

MATERIALS: MAESTRO 75DF (captan); PHYTON-27 (5.5% metallic copper); CLEAN CROP COPPER 53% WP (tribasic copper sulfate)

METHODS: The experiment was conducted at Cambridge, NS in a third year fruiting bed, cv. Honeoye. The experimental design was a randomized complete block with four replications. Each replicate consisted of one row, 5 m long. Fungicides were applied using a hand held pressurized CO_2 sprayer using 2400 L water/ha at 207 kPa. Treatments were applied May 24 (blossom buds visible in crown), May 31 (20% bloom), June 7 (full bloom) and June 14. Plots were assessed on June 20 by visually examining 75 leaflets and 25 fruit clusters/plot.

RESULTS: As presented in table.

CONCLUSIONS: Clean Crop Copper provided good control of angular leaf spot on both the leaflets and fruit calyses. Phyton and Maestro were ineffective. No phytotoxicity was observed with any of the treatments.

Table 1. Percent leaflets and fruit calyses infected with angular leaf spot.

Treatment	Rate (Product/ha)	% Infected Leaflets	% Infected Fruit Calyses
Clean Crop Copper 53WP	2.5 kg	9.7 a*	12.0 a
Maestro 75DF	4.5 kg	26.0 b	41.6 b
Phyton-27	2.0 L	40.3 b	47.2 b
Control (Water)	--	34.3 b	36.2 b

* Means followed by the same letter are not significantly different using Duncan's Multiple Range Test (P = 0.05).

#094 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE:

CROP: Strawberry, cv. Kent

PEST: Common leafspot, *Mycosphaerella fragariae* (Tul.)Lindau

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TITLE: CONTROL OF COMMON LEAFSPOT OF STRAWBERRY

MATERIALS: MAESTRO 75DF (captan); PHYTON-27 (5.5% metallic copper); TRI-COP 53 WP (tribasic copper sulfate)

METHODS: The experiment was conducted at Great Village, NS in a second year fruiting bed, cv. Kent. The experimental design was a randomized complete block with four replications. Each replicate was 7 rows wide (10.7 m) and 30.5 m long. Fungicides were applied using a tractor drawn Hardy sprayer equipped with a 12.2 m boom, 1533-30 nozzles and using 690 kPa pressure with 1270 L water/ha. Treatments were applied May 24, June 4, 12 and 21. Plots were assessed on June 30 by visually examining 50 leaves/plot for common leafspot.

RESULTS: As presented in table.

CONCLUSIONS: This trial was conducted to determine efficacy of copper fungicides on angular leaf spot. No angular leaf spot appeared in the field but ratings on common leaf spot were taken. All fungicides provided significant control of common leaf spot. No phytotoxicity was observed with any of the treatments.

Table 1. Percent leaflets with common leafspot.

Treatment	Rate (product/ha)	% leaflets with leafspot
MAESTRO 75DF	4.5 kg	32.0 a*
TRI-COP 53W	2.5 kg	36.2 ab
PHYTON-27	2.0 L	43.3 b
Control (water)	--	82.0 c

* Means followed by the same letter are not significantly different using Duncan's Multiple Range Test (P = 0.05).

PLANT PATHOLOGY / PYTOPATHOLOGIE

VEGETABLE AND SPECIAL CROPS / LÉGUMES ET CULTURES SPÉCIALES

Section Editor / Réviseur de section : R. Cerkauskas

#095 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 93000482

CROP: Bean, dry (*Phaseolus vulgaris* L.), cv. Othello

PEST: Halo blight, *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

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TITLE: EFFICACY OF SEED TREATMENTS FOR THE CONTROL OF HALO BLIGHT ON DRY EDIBLE BEANS: I. GREENHOUSE TRIALS AT BROOKS, ALBERTA IN 1995

MATERIALS: AGRICULTURAL STREPTOMYCIN (streptomycin sulphate 62.6% WP, equivalent to 50% streptomycin base); CAPTAN 30-DD (captan 28.7% SU); STREPTOMYCIN 17 (streptomycin sulfate 17% WP); CAPTAN 400 (captan 37.4% SU)

METHODS: Separate 1000 g lots of Othello pinto bean seed naturally infested with *Pseudomonas syringae* pv. *phaseolicola* were treated with three rates of AGRICULTURAL STREPTOMYCIN + CAPTAN 30-DD, one rate of CAPTAN 30-DD, two rates of STREPTOMYCIN 17 + CAPTAN 400, and one rate of CAPTAN 400. The prescribed amounts of AGRICULTURAL STREPTOMYCIN were each mixed in 3.5 ml of water, and 13.0 ml of water was added to each portion of STREPTOMYCIN 17. Each chemical treatment (Table 1) was applied to a 1000 g lot of seed as a slurry. The CAPTAN 30-DD alone and CAPTAN 400 alone treatments were supplemented with 3.5 ml of water to ensure even seed coverage. An additional lot of bean seed was treated with tap water as a check. The seed treatments were applied with a Gustafson Batch Lab Treater. Before each test lot was treated, 1000 g of seed was run through the treater to pre-coat the drum with the respective treatment in order to minimize adhesion losses. On June 14, the treated and untreated seeds were planted in non-pasteurized sandy loam field soil. Each treatment consisted of eight, 15 cm diameter pots (replicates) with 25 seeds/pot. The pots were placed in a greenhouse at Brooks. Emergence counts were done on June 26 and the data were tabulated and subjected to ANOVA. Afterwards, the plants were thinned to 10/pot and the pots were placed in a humid chamber in order to provide a favourable microclimate for halo blight development. Disease ratings were done on August 3.

The trial was repeated on June 26 using identical procedures to the first one, except that Ready-Mix, a soilless, peat-based planting medium was used instead of field soil. Emergence counts were done July 5. The pots were placed in the humid chamber until August 3, when they were rated for halo blight incidence.

RESULTS: Seed treated with AGRICULTURAL STREPTOMYCIN + CAPTAN 30-DD grew the best, but there were no significant differences in emergence between this treatment and any others, including the check, for either the field soil or Ready-Mix (Table 1). Halo blight symptoms were not observed on the bean plants in either trial.

CONCLUSIONS: The poor emergence in the field soil may have been due to high populations of pathogenic fungi. The failure to observe halo blight suggests that environmental conditions provided in these trials were not favourable enough for the development of this disease.

Table 1. Percent emergence of Othello dry bean plants grown from seed treated with two bactericides (AGRICULTURAL STREPTOMYCIN and STREPTOMYCIN 17) and two fungicides (CAPTAN 30-DD and CAPTAN 400), alone and in various combinations, in a greenhouse trial at Brooks, Alberta, in 1995.

Treatment	Rate of product /kg seed	Emergence (%)* Seeded June 14**	 Seeded June 26
		Sandy loam	Ready-Mix
AGRICULTURAL STREPTOMYCIN + CAPTAN 30-DD	0.2 g+1.5 ml	4.5	97.0
AGRICULTURAL STREPTOMYCIN + CAPTAN 30-DD	0.4 g+1.5 ml	9.1	94.0
AGRICULTURAL STREPTOMYCIN + CAPTAN 30-DD	1.0 g+1.5 ml	15.0	98.0
CAPTAN 30-DD	1.5 ml	5.7	96.5
STREPTOMYCIN 17 + CAPTAN 400	0.5 g+1.5 ml	5.9	93.5
STREPTOMYCIN 17 + CAPTAN 400	1.0 g+1.5 ml	4.6	94.0
CAPTAN 400	1.5 ml	6.4	95.5
Untreated Check	--	9.6	97.5
ANOVA P• 0.05		ns	ns
Coefficient of Variation (%)		88.5	4.8

* These values are the means of eight replications.

** These data were arcsin-transformed before ANOVA and the detransformed means are present here.

#096 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 93000482

CROP: Bean, dry (*Phaseolus vulgaris* L.), cv. Othello

PEST: Halo blight, *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

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TITLE: EFFICACY OF SEED TREATMENTS FOR THE CONTROL OF HALO BLIGHT ON DRY EDIBLE BEANS: II. FIELD TRIALS IN ALBERTA, SASKATCHEWAN AND MANITOBA IN 1995

MATERIALS: AGRICULTURAL STREPTOMYCIN (streptomycin sulphate 62.6% WP, equivalent to 50% streptomycin base); CAPTAN 30-DD (captan 28.7% SU); STREPTOMYCIN 17 (streptomycin sulfate 17% WP); CAPTAN 400 (captan 37.4% SU)

METHODS: Othello pinto bean seed naturally infested with *Pseudomonas syringae* pv. *phaseolicola* was treated with three rates of AGRICULTURAL STREPTOMYCIN + CAPTAN 30-DD, one rate of CAPTAN 30-DD alone, two rates of STREPTOMYCIN 17 + CAPTAN 400, and one rate of CAPTAN 400 alone (Tables 1-4). The prescribed amounts of AGRICULTURAL STREPTOMYCIN were each mixed in 3.5 ml of water, and 13.0 ml of water was added to each portion of STREPTOMYCIN 17. Each chemical treatment was applied as a slurry to a separate 1000 g lot of seed. The CAPTAN 30-DD alone and CAPTAN 400 alone treatments were supplemented with 3.5 ml tap water to ensure even coverage. An additional lot of seed was treated with tap water as a control. The seed treatments were applied with a Gustafson Batch Lab Treater. Before each test lot was treated, 1000 g of seed was run through the treater to pre-coat the drum with the respective chemical treatment in order to minimize adhesion losses. The treated and untreated seeds were planted with a hand-driven cone seeder in field plots at Morden on May 16, at Brooks on May 24 and at Outlook on June 2. A randomized block design with four replications was used. Each subplot consisted of one, 5 m row, and 120 seeds were planted/row. Each row of beans was bordered by two rows of oats planted no closer than 30 cm on either side, and oats were also seeded between the replicate blocks. The grain was planted to reduce the risk of interplot interference from splash-dispersed bacteria.

Emergence was determined by counting all of the plants in each row. Counts were made at Brooks on June 15 and at Morden on June 23; no counts were done at Outlook. Halo blight incidence (% plants affected) and severity were rated on June 20, July 7 and August 2 at Brooks, on July 5, July 20 and August 8 at Morden, and on July 26 at Outlook. The visual assessment key for common bacterial blight of beans developed by James (1971) was used to estimate severity, i.e. 0 = no disease, 1 = slight (1-10% leaf area blighted), 2 = moderate (11 -25% blighted), 3 = severe (26-50% blighted), and 4 = very severe (>50% blighted). Severity ratings at Brooks were done on 25 randomly selected leaves/row, while at Morden 100 leaves/row were used. Varying numbers of leaves per treatment (range 5-25) were sampled at Outlook because of severe wind damage to the plants. The trials at Morden and Outlook were harvested on August 25 and October 10, respectively. No yield data were taken at Brooks.

RESULTS: As presented in the tables.
Brooks - There were no significant differences in emergence amongst treatments (Table 1). On June 30 and July 7, blight incidence in most of the chemical treatments was generally lower than in the check, but these differences were not statistically significant. By August 2, both the CAPTAN 30-DD alone and AGRICULTURAL STREPTOMYCIN (1.0 g/kg) + CAPTAN 30-DD plots had significantly fewer blighted plants, whereas the remaining treatments were no better than the check. Disease severity ratings were very low and none of the chemical treatments significantly reduced blight levels compared to the check (Table 2).
Morden - There were no significant differences in emergence between the chemical treatments and the check (Table 3). Furthermore, none of the chemicals tested significantly reduced the incidence of halo blight relative to the check. A similar trend was seen in blight severity ratings (Table 4). Yield data were more definitive, where at least two treatments (AGRICULTURAL STREPTOMYCIN (1.0 g/kg) + CAPTAN 30-DD and AGRICULTURAL STREPTOMYCIN 17 (1.0 g/kg) + CAPTAN 400 significantly outproduced the check.
Outlook - AGRICULTURAL STREPTOMYCIN (0.2 g/kg) + CAPTAN 30-DD and CAPTAN 30-DD alone were the only treatments where disease incidence was significantly less than the check (Table 5). There were no significant differences in severity ratings or yields amongst treatments. Poor plant stands, wind damage to the foliage, and low levels of disease made it difficult to critically evaluate the products under test at this location.

CONCLUSIONS: At least 0.4 g/kg and preferably 1.0 g/kg of either AGRICULTURAL STREPTOMYCIN or STREPTOMYCIN 17 had to be applied to infested bean seed to produce a significant reduction in halo blight and a corresponding increase in yield relative to untreated seed under the conditions of this trial.

Table 1. Percent emergence and incidence of halo blight on Othello dry beans grown from seed treated with two bactericides (AGRICULTURAL STREPTOMYCIN and STREPTOMYCIN 17) and two fungicides (CAPTAN 30-DD and CAPTAN 400), alone or in various combinations, in a field trial at Brooks, Alberta, in 1995.*

Treatment	Rate of product/ kg seed	Emergence (%)	Disease incidence (%)**		
			June 30	July 7	Aug. 2
AG STREPTOMYCIN + CAPTAN 30-DD	0.2 g+1.5 ml	78.2	10.3	39.9	55.3 ab
AG STREPTOMYCIN + CAPTAN 30-DD	0.4 g+1.5 ml	83.8	12.6	41.8	54.4 ab
AG STREPTOMYCIN + CAPTAN 30-DD	1.0 g+1.5 ml	77.1	6.8	31.1	36.5 b
CAPTAN 30-DD	1.5 ml	80.2	8.1	29.7	45.8 b
STREPTOMYCIN 17 + CAPTAN 400	0.5 g+1.5 ml	75.3	9.8	50.3	59.6 ab
STREPTOMYCIN 17 + CAPTAN 400	1.0 g+1.5 ml	70.9	9.9	32.3	52.8 ab
CAPTAN 400	1.5 ml	77.1	11.6	59.2	72.7 a
Untreated Check	--	76.1	14.2	53.4	72.8 a
ANOVA P• 0.05		ns	ns	ns	s
Coefficient of Variation (%)		12.3	22.2	24.6	15.8

* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

** These data were arcsin-transformed before ANOVA and the detransformed means are present here.

Table 2. Severity of halo blight on Othello dry beans grown from seed treated with two bactericides (AGRICULTURAL STREPTOMYCIN and STREPTOMYCIN 17) and two fungicides (CAPTAN 30-DD and CAPTAN 400), alone or in various combinations, in a field trial at Brooks, Alberta, in 1995.*

Treatment	Rate of product/ kg seed	Severity (0-4)			Yield (g/5m row)
		June 30	July 7	Aug. 3	
AG STREPTOMYCIN + CAPTAN 30-DD	0.2 g+1.5 ml	0.3	0.6	0.9	--
AG STREPTOMYCIN + CAPTAN 30-DD	0.4 g+1.5 ml	0.4	0.7	0.9	--
AG STREPTOMYCIN + CAPTAN 30-DD	1.0 g+1.5 ml	0.3	0.5	0.6	--
CAPTAN 30-DD	1.5 ml	0.3	0.6	0.9	--
STREPTOMYCIN 17 + CAPTAN 400	0.5 g+1.5 ml	0.3	0.8	0.9	--
STREPTOMYCIN 17 + CAPTAN 400	1.0 g+1.5 ml	0.2	0.5	0.7	--
CAPTAN 400	1.5 ml	0.3	0.9	0.9	--
Untreated Check	--	0.4	0.7	1.0	--
ANOVA P• 0.05		ns	ns	ns	
Coefficient of Variation (%)		34.0	39.6	26.0	

* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

Table 3. Percent emergence and incidence of halo blight on Othello dry beans grown from seed treated with two bactericides (AGRICULTURAL STREPTOMYCIN and STREPTOMYCIN 17) and two fungicides (CAPTAN 30-DD and CAPTAN 400), alone or in various combinations, in a field trial at Morden, Manitoba, in 1995.*

Treatment	Rate of product/ kg seed	Emergence (%)	Disease incidence (%)**		
			July 5	July 20	Aug. 8
AG STREPTOMYCIN + CAPTAN 30-DD	0.2 g+1.5 ml	76.1	15.3	16.7	26.8
AG STREPTOMYCIN + CAPTAN 30-DD	0.4 g+1.5 ml	79.2	10.9	13.5	26.9
AG STREPTOMYCIN + CAPTAN 30-DD	1.0 g+1.5 ml	78.5	8.1	8.7	9.8
CAPTAN 30-DD	1.5 ml	78.0	11.6	16.1	17.8
STREPTOMYCIN 17 + CAPTAN 400	0.5 g+1.5 ml	77.0	4.4	6.5	11.5
STREPTOMYCIN 17 + CAPTAN 400	1.0 g+/1.5 ml	78.2	8.8	8.6	13.3
CAPTAN 400	1.5 ml	74.6	10.2	9.5	18.6
Untreated Check	--	72.6	6.2	5.7	16.1
ANOVA P• 0.05		ns	ns	ns	ns
Coefficient of Variation (%)		8.3	47.0	37.8	29.1

* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

** These data were arcsin-transformed before ANOVA and the detransformed means are present here.

Table 4. Severity of halo blight and yield of Othello dry beans grown from seed treated with two bactericides (AGRICULTURAL STREPTOMYCIN and STREPTOMYCIN 17) and two fungicides (CAPTAN 30-DD and CAPTAN 400), alone or in various combinations, in a field trial at Morden, Manitoba, in 1995.*

Treatment	Rate of product/ kg seed	Severity (0-4)			Yield (g/5m row)
		July 5	July 20	Aug. 8	
AG STREPTOMYCIN + CAPTAN 30-DD	0.2 g+1.5 ml	1.0	1.0	1.5	1194.3 b
AG STREPTOMYCIN + CAPTAN 30-DD	0.4 g+1.5 ml	1.0	1.0	1.3	1300.2 ab
AG STREPTOMYCIN + CAPTAN 30-DD	1.0 g+1.5 ml	1.0	1.0	1.0	1569.3 a
CAPTAN 30-DD	1.5 ml	1.0	1.0	1.3	1329.8 ab
STREPTOMYCIN 17 + CAPTAN 400	0.5 g+1.5 ml	1.0	1.0	1.0	1466.9 ab
STREPTOMYCIN 17 + CAPTAN 400	1.0 g+1.5 ml	1.0	1.0	1.0	1538.7 a
CAPTAN 400	1.5 ml	1.0	1.0	1.0	1206.6 b
Untreated Check	--	1.0	1.0	1.0	1211.9 b
ANOVA P• 0.05		ns	ns	ns	s
Coefficient of Variation (%)		0.0	0.0	25.7	14.2

* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

Table 5. Percent emergence, incidence as well as severity and yield of Othello dry beans grown from seed treated with two bactericides (AGRICULTURAL STREPTOMYCIN and STREPTOMYCIN 17) and two fungicides (CAPTAN 30-DD and CAPTAN 400), alone or in various combinations, in a field trial at Outlook, Saskatchewan, in 1995.*

Treatment	Rate of product/ kg seed	Emergence (%)	Disease incidence (%)**	Disease severity (0-4)	Yield (g/5m row)
AG STREPTOMYCIN + CAPTAN 30-DD	0.2 g+1.5 ml	--	14.6 b	1.4	670.1
AG STREPTOMYCIN + CAPTAN 30-DD	0.4 g+1.5 ml	--	41.0 a	1.5	614.1
AG STREPTOMYCIN + CAPTAN 30-DD	1.0 g+1.5 ml	--	29.8 ab	1.7	510.8
CAPTAN 30-DD	1.5 ml	--	17.2 b	1.5	580.7
STREPTOMYCIN 17 + CAPTAN 400	0.5 g+1.5 ml	--	28.7 ab	1.7	413.5
STREPTOMYCIN 17 + CAPTAN 400	1.0 g+1.5 ml	--	45.0 a	1.7	512.9
CAPTAN 400	1.5 ml	--	33.6 ab	1.4	519.8
Untreated Check	--	--	47.5 a	1.9	623.3
ANOVA P• 0.05			s	ns	ns
Coefficient of Variation (%)			27.0	19.9	19.4

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* These values are the means of four replications. Numbers within a column followed by the same small letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

** These data were arcsin-transformed before ANOVA and the detransformed means are present here.

#097 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 93000482

CROP: Bean, dry (*Phaseolus vulgaris* L.), cv. Great Northern US1140

PEST: White mold, *Sclerotinia sclerotiorum* (Lib.) de Bary

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TITLE: EFFICACY OF CALCIUM SPRAY TREATMENTS FOR THE CONTROL OF WHITE MOLD ON EDIBLE DRY BEANS IN SOUTHERN ALBERTA IN 1995

MATERIALS: CALCIUM CARBONATE ($CaCO_3$; 40.04% Ca);
CALCIUM ACETATE ($Ca(C_2H_3O_2)_2 \cdot H_2O$; 22.7% Ca);
CALCIUM NITRATE ($Ca(NO_3)_2 \cdot H_2O$; 16.97% Ca);
CALCIUM CHLORIDE ($CaCl_2 \cdot 2H_2O$; 27.3% Ca);
CALCIUM PHOSPHATE ($Ca(H_2PO_4)_2$; 15.9% Ca);
CALCIUM SULPHATE ($CaSO_4 \cdot 2H_2O$; 23.3% Ca);
CALCIUM HYDROXIDE ($Ca(OH)_2$; 54.1% Ca);
BENLATE (benomyl 50% WP)

METHODS: This trial was conducted in a commercial dry bean field near Rolling Hills, Alberta. The plot rows were 16.5 m long and the row spacing was 60 cm. Each chemical treatment (Table 1) was applied to four, 10 m^2 subplots. A similar set of subplots was sprayed with tap water as an untreated check. The treatments were arranged in a randomized complete block design with four replications. The sprays were applied with a CO_2-propelled, hand-held sprayer equipped with one, Tee Jet 8001 nozzle. The spray was directed onto both sides of each row to ensure complete coverage. The equivalent of 375 L/ha of spray mixture was applied to each subplot using a boom pressure of 250 kPa. The bean plots had a heavy canopy and were podding at the time the sprays were applied on August 8, and no white mold symptoms were evident. Seven different calcium-containing products were applied at rates ranging from 1.9 to 6.3 kg of product/ha. These rates reflected an application of 1.0 kg/ha of actual calcium. BENLATE was applied at 2.24 kg/ha as a commercial standard against which the calcium products could be compared.

On August 25, the total number of plants, as well as the number of plants with white mold symptoms, were recorded along a 2 m section in the centre of each of the treatment rows. These data were converted to % infected plants, arcsin-transformed and subjected to ANOVA.

RESULTS: Disease levels within the plot were moderately high but variable. Although the subplots treated with CALCIUM ACETATE, CALCIUM PHOSPHATE and CALCIUM HYDROXIDE all had substantially less white mold than both the BENLATE-treated and check subplots, these differences were not statistically significant (Table 1).

CONCLUSIONS: The data suggest that CALCIUM ACETATE, CALCIUM PHOSPHATE and CALCIUM HYDROXIDE may have potential for controlling white mold on dry beans. These products sequester oxalic acid, which is produced by the pathogen in the infection court, thereby reducing disease levels. Further tests will have to be done before any definite conclusions can be drawn about the possible commercial use of calcium products for white mold control in beans.

Table 1. The incidence of white mold in Great Northern dry beans sprayed with seven calcium products and BENLATE at Rolling Hills, Alberta, in 1995.*

Treatment	Rate (product/ha)	% plants with white mold**
CALCIUM CARBONATE	2.5 kg	39.5
CALCIUM ACETATE	4.4 kg	20.1
CALCIUM CHLORIDE	3.8 kg	34.8
CALCIUM PHOSPHATE	6.3 kg	18.4
CALCIUM SULPHATE	4.3 kg	40.9
CALCIUM HYDROXIDE	1.9 kg	24.7
CALCIUM NITRATE	5.9 kg	54.7
BENLATE	2.24 kg	34.9
Check (water only)	--	46.6
ANOVA P• 0.05	--	ns
Coefficient of Variation (%)		34.7

* Each value in this table is the mean of four replications.

** These data were arcsin-transformed prior to ANOVA and the detransformed means are presented here.

#098 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Bean, white, cv. OAC Gryphon

PEST: Bean anthracnose, *Colletotrichum lindemuthianum* race *alpha-Brazil*

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TITLE: EVALUATION OF SEED TREATMENTS AGAINST ANTHRACNOSE IN WHITE BEAN, 1994

MATERIALS: Anchor F; DCT P; Benomyl 50% wp; Captan 80% wp; Metalaxyl 50% wp; Thiabendazole 40% wp; Thiram 75% wp

METHODS: Eight potential seed treatment compounds were tested for efficacy against anthracnose. Four were eliminated. The other four included captan-thiram-metalaxyl-benomyl

(CTMB), diazinon-captan-thiophanate methyl (DCT), thiram-metalaxyl-thiabendazole (TMZ) and anchor (Carbathiin + Thiram) were further tested with water check. The seeds with visible anthracnose infection were divided into four groups according to the size of the lesions with 1 = no lesions, 2 = <2 mm, 3 = 2 to 4 mm and 4 = 4 to 6 mm in diameter or length. The rate of application for DCT and anchor was 5.2 and 6.0 g/kg of seed, respectively. For the others, the rates used (g a.i/kg of seed) were: captan, 1.25; thiram 1.25; metalaxyl, 0.15; benomyl, 1.25 and thiabendazole, 0.30. For each treatment, 200 g of each group of seeds was mixed inside a 1L beaker with a rubber rod. Treated and nontreated seeds were planted, 4 seeds/pot, in 10x10cm pots filled with greenhouse potting soil (loam:peat:sand, 2:1:1). Each combination of seed treatments and groups of seeds had 10 replicate pots. After sowing, the pots were arranged in randomized blocks and placed in a moist chamber (1.5 m x 3 m) in a 22•C greenhouse for one week. Later, the pots were removed from the chamber to a bench in the same greenhouse. Two weeks after sowing, percent emergence was determined. Disease incidence and severity were determined five and six weeks after sowing, respectively. Disease severity was assessed based on a 0 - 9 scale, i.e., 0 = no disease symptom, 1 = trace to 10% diseased area, 2 = 11 to 20%, . . . , and 9 = plant dead. The experiment was repeated once. Observations of repeated experiments were subjected to analyses of homogeneity of variance and combined accordingly. Statistics was performed on the combined data using SAS PROC GLM. The terms in the model included block, treatment, lesion size (Linear effect and quadratic effect) and treatment X lesion size. Significant treatment X lesion size interaction suggested that the data could not be simply averaged across lesion sizes. One way ANOVA was performed for treatments within each group of lesion size. Fisher's protected least significant difference (P<0.05) was used for mean separation. Simple regression was performed for the response of each treatment to different lesion sizes.

RESULTS: For percent seed emergence, difference among treatments and treatment X lesion size interaction were not significant. However, the treated seeds, especial those treated with CTMB, germinated better than nontreated seeds (Table 1). In treated seeds, percent seed emergence was negatively related to the lesion size on seed. Severely infected seeds resulted in low plant stands. All seed treatments provided significant control of bean anthracnose compared to the nontreated check (Table 2). The interaction between treatment and lesion size was also significant (P<0.0001) with respect to disease incidence and severity. This phenomenon showed that the efficacy of these chemicals against severely infected seeds was less predictable. CTMB was more superior to DCT and provided excellent anthracnose control on seeds with moderate to severe infection. Anchor, TMZ and DCT were effective in seeds with light to moderate severity of infection but their effectiveness decreased significantly as the size of the lesion increased (P<0.0009--0.0001).

CONCLUSION: The four seed treatment compounds (CTMB, DCT, TMZ and Anchor) are effective in controlling the alpha-Brazil race of bean anthracnose and they effectively increase the emergence of infected seeds. CTMB is a most promising seed treatment compound.

Table 1. Effect of seed treatments on emergence of anthracnose infected seeds.

Treatment	Percent emergence (%) Size of lesions on seeds (mm) 0	<2	2-4	4-6	Mean
Check	100.0±0.0*	84.5±5.0	82.0±8.1	70.0±9.6	84.0a
DCT	94.0±3.1	92.0±3.3	90.0±3.3	78.0±6.3	88.5a
TMZ	94.0±3.1	90.3±3.3	86.0±6.7	74.0±7.3	86.0a
Anchor	92.0±6.0	86.0±6.7	92.0±3.3	74.0±6.0	86.0a
CTMB	100.0±0.0	94.0±3.1	90.0±4.5	80.0±5.2	91.0a
Mean	96.0	89.2	88.0	75.2	

Analyses of variance:
Treatment (P<0.2881 ns)
linear effect of lesion size (P<0.0001)
Treatment X lesion size (P<0.9261 ns)

* The mean of 20 replicates and its standard error.

Table 2. Effect of seed treatments on disease incidence and disease severity in plants grown from seeds with varying degree of anthracnose infection.

Treatment	Incidence of anthracnose disease % (Disease severity %*) Size of lesions on seeds (mm) 0	<2	2-4	4-6	Regression Pr>F
Check	54.0a(11.8a)**	79.8a(42.9a)	98.0a(79.9a)	100.0a(87.4a)	0.0001(0.0001)
DCT	0.0b(0.0b)	2.5b(0.6b)	16.0c(7.1c)	38.2c(14.0c)	0.0001(0.0001)
TMZ	2.5b(0.6b)	2.5b(0.6b)	16.0c(4.3c)	23.8c(7.8cd)	0.0009(0.0001)
Anchor	2.0b(0.2b)	2.5b(0.8b)	55.0b(26.9b)	72.0b(33.1b)	0.0001(0.0001)
CTMB	0.0b(0.0b)	2.5b(0.8b)	0.0c(0.0c)	2.5d(0.6d)	0.5395(0.7173)
$FLSD_{0.05}$	3.4 (3.1)	9.0 (5.6)	17.4 (10.9)	16.9 (11.1)	

* Disease severity was assessed based on a 0-9 scale, in which 0 = no disease symptom, 1 = trace to 10% diseased area, 2 = 11-20%, . . . , and 9 = plant dead.

** Each value is the mean of 20 replications. Figures in parentheses represent the disease severity index. Means followed by the same letter are not significantly different according to the Fisher's protected least difference (P<0.05).

#099 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 206003

CROP: Beet, red cv. Big Red and Detroit Dark Red

PEST: Cercospora leaf spot, *Cercospora beticola* Sacc.

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TITLE: EVALUATION OF FUNGICIDES FOR THE CONTROL OF CERCOSPORA LEAF SPOT ON RED BEETS, 1995

MATERIALS: KOCIDE 101 (metallic copper 50%); DITHANE M-45 (mancozeb 80%); BRAVO 500 (chlorothalonil 50%)

METHODS: Red beets were seeded at the Muck Research Station on June 27 at 38 seeds/m. A randomized complete block arrangement with 3 blocks/treatment was used. Each replicate consisted of 3 rows of cv. Big Red and 3 rows of cv. Detroit Dark Red. Rows were 55 cm apart and 5 m in length. The treatments consisted of KOCIDE 101 applied at 4.5 kg/ha, DITHANE M-45 applied at 2.25 kg/ha and BRAVO 500 applied at 2.0 L/ha. An untreated check was also included. All fungicides were applied as foliar sprays using a solid cone spray nozzle at 80 p.s.i. and 400 L/ha water. Treatments were applied on August 17, 23, 28 and September 6, 12, 20 and 28. Twenty-five plants per cultivar per replicate were harvested on October 10 and 11. The 5 lowest leaves on each plant with approximately 80% or more non-necrotic tissue were rated for percent green leaf area. The number of green and dead leaves on each plant was also recorded. The data were analysed using the General Analysis of Variance of the Linear Models function of Statistix V. 4.1.

RESULTS: As presented in tables.

CONCLUSIONS: Differences were found in the susceptibility of the two cultivars to Cercospora leaf spot. Analysis of main effects showed that Detroit Dark Red had more green leaves per plant than Big Red (10.7 and 9.3, respectively) but Big Red had a higher percentage of green leaf tissue (96.3 vs. 94.1 %). Sprays with BRAVO 500 increased the percent of green tissue on both cultivars. Treatment with DITHANE M-45 increased the percentage of green leaf tissue on Detroit Dark Red and but decreased the number of green leaves on Big Red. Fungicide application did not affect the number of dead leaves per plant.

Table 1. Evaluation of KOCIDE 101, DITHANE M-45, and BRAVO 500 for control of Cercospora leaf spot of beets on cv. Big Red.

Treatment	Rate product/ha	Percent green tissue	no. green leaves/plant	no. of dead leaves/plant
Control	----	94.3 b*	10.5 a	5.12 a
KOCIDE 101	4.5 kg	96.0 ab	10.0 a	4.93 a
DITHANE M-45	2.25 kg	97.3 ab	7.3 b	4.61 a
BRAVO 500	2.0 L	98.0 a	9.5 a	4.81 a

Table 2. Evaluation of KOCIDE 101, DITHANE M-45, and BRAVO 500 for control of Cercospora leaf spot of beets on cv. Detroit Dark Red.

Treatment	Rate product/ha	Percent green tissue	no. green leaves/plant	no. of dead leaves/plant
Control	----	89.3 b	10.2 a	4.81 a
KOCIDE 101	4.5 kg	91.0 b	12.0 a	4.99 a
DITHANE M-45	2.25 kg	97.7 a	10.1 a	4.75 a
BRAVO 500	2.0 L	98.3 a	10.7 a	5.33 a

Table 3. Main effects of susceptibility of two beet cultivars, Detroit Dark Red and Big Red to Cercospora leaf spot.

Cultivar	Percent green tissue	no. green leaves/plant	no. of dead leaves/plant
Detroit Dark Red	10.7 a	94.1 b	5.0 a
Big Red	9.3 b	96.3 a	4.9 a

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#100 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 300 1251 9102

CROP: Cabbage, Chinese, *Brassica campestris* var. *pekinensis* L.

PEST: *Plasmodiophora brassicae* Wor.

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TITLE: SUPPRESSION OF CLUBROOT BY TREATING SOIL WITH CRUSHED CRABSHELL

MATERIALS: Meat-free (shucked) crabs legs; field site and infested soil; Chinese cabbage cv. Granaat seed and Michihli seedlings.

METHODS: Two trials were conducted at the St. John's Research Centre in a stony loam soil heavily infested with *P. brassicae*. Each trial was a randomized complete block design: three transplant replicates, and four seeded replicates. The crabshell was obtained locally from a crab processing plant. The meat was squeezed out of the legs and the shucked shell collected and dried at 60•C. The shell was crushed by grinding the shell underfoot until a fine meal was obtained. The meal was incorporated into the top 5 cm of the soil with a hand rake to give 0% or 1% (w/w) crabshell. In the first trial, Granaat was sown at the rate of 2 seeds/m (July 5) directly into the soil. In the second trial, 6 week old Michihli seedlings were transplanted (July 12) into the soil. Three rows of nine transplants each (harvested September 1), and four rows of 14 plants (from seed) (harvested September 15) were evaluated, respectively. The data were analysed by Genstat.

RESULTS: In the first trial, all plants were clubbed. In the second trial, however, disease incidences were 96% for control and 62% for treated plants.

CONCLUSION: The crabshell level at 1% of soil may be too low to be effective overall, and a subsequent field test at higher crabshell levels should be conducted.

#101 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 206003

CROP: Carrot, cv. Six Pak

PEST: Sclerotinia rot, *Sclerotinia sclerotiorum* (Lib de Bary)

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TITLE: EVALUATION OF FUNGICIDES AND CALCIUM FOR THE CONTROL OF SCLEROTINIA ON CARROTS IN STORAGE, 1994/95

MATERIALS: BENLATE 50 WP (benomyl); CALCIUM NITRATE 15.5% (calcium 19%)

METHODS: Carrots were seeded on June 1, 1994 (96/m) in naturally infested soil at the Muck Research Station. Plots were 4 rows wide (55 cm between rows), 5 m in length and replicated 4 times in a randomized complete block design. There were four fungicide treatments: BENLATE at 3.4 kg/ha and CALCIUM NITRATE at 0.01, 0.1 or 1.0% Ca. An untreated check was also included. BENLATE was applied on September 2, 9 and 30 approximately 75, 68 and 47 d before harvest. CALCIUM NITRATE was applied on September 2, 9, 23 and 30 and October 7, 17 and 28, between 75 and 19 d before harvest. All treatments were applied using a solo backpack sprayer in 1,000 L of water/ha. Carrots were harvested from 5 m of row, from each plot on November 15 and 17, 1994. Treatments were placed in storage after harvest. Twenty half bushels (approx. 10 kg) were harvested on November 18 from untreated check plots. These were washed and dipped for 30 sec. in solutions of the same products as were applied in the field. All samples were placed in plastic containers and put in a Filacell Storage where temperature and relative humidity were kept at approximately 1• C and 90% respectively. The number of carrots with and without visible white mold (Sclerotinia) were counted on February 1 and 2 and April 26 and 27, 1995. Data was analysed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1.

RESULTS: As presented in Table 1.

CONCLUSIONS: Differences were found among the drench treatments but not those applied in the field. When the drenched carrots were assessed in February, those treated with 0.1% calcium had less disease than the check, while those treated with a 1% solution had more disease. By April, carrots dipped in BENLATE, or 0.01% and 0.1% CALCIUM NITRATE had less disease than the washed check. Washing carrots prior to storage significantly increased the incidence of Sclerotinia white mold.

Table 1. Control of Sclerotinia on Carrots in Storage in 1994-95.

	Rate		Percent Disease			
	Field applic. kg/ha product	Post-harvest drench product (g) per L H_2O	February		April	
			Field	Drench	Field	Drench
BENLATE 50 WP	3.4	2.2	2.4 a*	16.2 de	6.0 a	65.3 d
CALCIUM 0.01%	1.8	0.1	7.1 abc	15.3 cde	14.4 a	53.1 cd
CALCIUM 0.1%	18	1.0	5.7 ab	13.6 bcd	13.5 a	50.8 bc
CALCIUM 1.0%	180	10.0	5.7 ab	35.4 f	8.8 a	92.8 e
Check	----	----	7.1 a-d		20.1 ab	
Washed Check	----	----		23.6 e		87.2 e

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#102 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 375-1411-8719

CROP: Canola, *Brassica rapa*, cultivar Parkland

PEST: Alternaria blackspot, *Alternaria* spp.

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TITLE: EFFECT OF FUNGICIDE APPLICATION ON ALTERNARIA BLACK SPOT IN AC PARKLAND CANOLA, 1995

MATERIALS: Bravo 500 (chlorothalonil 500 g/L); Rovral WDG granular (iprodione 500 g/kg), Rovral Flo (iprodione 250 g/L); ICIA-5504 (azoxystrobin 80% WG)

The authors wish to thank Mr. Ed Seidle for his generous support of this research project.

METHODS: The test was established at Medstead, Saskatchewan in 1995 in a commercially grown field of AC Parkland canola. Naturally occurring inoculum of *Alternaria* spp. was relied upon for infection. The test was a randomized complete block design with four replicates. The plots were established on June 21 by rotovating a 1 m area around each replicate. Plots within the replicates were 5 m long x 2 m wide with one half of a metre of crop on either side as a guard. Rows were 15 cm apart. Seeding occurred on May 27. All treatments were sprayed using a hand-held, CO_2 pressurized, 4 nozzle boom sprayer at 35 psi. Lurmark 01-F80 nozzles were used with the exception of the Rovral Flo-4 treatment where a reduced water volume was used to simulate aircraft application. The water volume was 100 L/ha for Rovrai and ICIA-5504 treatments, and 225 L/ha for Bravo treatments. For the reduced volume application Teejet SS800050 nozzles were used and the water volume was 45 L/ha. Spraying Rovral Flo-1 occurred on July 6 at 20 to 30% bloom, or at inflorescence raised above level of rosette to first flowers open (F.R. Harper and B. Berkenkamp Can. J. Plant Sci. 55:657-658, 1975). All other spray treatments including a water sprayed control occurred on July 31 at 95% petal drop, or when lower pods were starting to fill and seeds in lower pods were green. Percent disease was visually assessed on main stem pods on August 21 when seeds in lower pods were green to green-brown in colour. Harvesting (8 rows x 5 m long) was done September 26 with yield recorded as kg/ha of dry grain.

RESULTS: As presented in the table. Yield was significantly (P = 0.05) increased over the control for Bravo 500-1, Rovral Flo-1, Rovral Flo-2, Rovral Flo-3, Rovral WDG, ICIA-5504-1, and ICIA-5504-2. All other treatments also increased yield although not significantly over the control. Yield increases over the control ranged from 14 to 36%. All treatments were significantly (P = 0.05) lower than the control for percent disease. Aside from blackspot no other diseases occurred at significant levels. Sclerotinia stem rot, blackleg and white rust/staghead only occurred in trace amounts (<1% incidence on plants).

CONCLUSIONS: An application of Rovral at 20-30% bloom was as effective as an application at 95% petal drop, and at 95% petal drop a half rate application was as effective as 500g a.i. Application with a reduced water volume was not as effective as other applications in increasing yield.

Table 1. The effect of foliar applied fungicides on mean percent disease of *Alternaria* black spot on main stem pods and yield of AC Parkland canola.

PRODUCT	RATE (/ha)	GROWTH STAGE	ALT. BLACK SPOT (% disease)*	YIELD (kg/ha)*
Control	----	95% petal drop	7.5a**	1579 c**
Bravo 500-1	1.85L	95% petal drop	3.8 bc	1904ab
Bravo 500-2	2.47L	95% petal drop	3.2 bc	1861abc
ICIA-5504-1	125g a.i.	95% petal drop	2.7 bc	1957ab
ICIA-5504-2	250g a.i.	95% petal drop	1.5 c	2141a
Rovral Flo-1	500g a.i.	20% bloom	4.0 bc	2155a
Rovral Flo-2	500g a.i.	95% petal drop	3.3 bc	1926ab
Rovral Flo-3	250g a.i.	95% petal drop	2.9 bc	2140a
Rovral Flo-4 reduced volume	500g a.i.	95% petal drop	4.7 b	1792 bc
Rovral WDG	500g a.i.	95% petal drop	2.1 bc	1914ab

* Based on mean of four replicates.

** Values in the same column which are not followed by the same letter are significantly different at the 5% level of probability according to Duncan's Multiple Range Test.

#103 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Canola, cv. Tobin

PEST: Alternaria blackspot, *Alternaria brassicae*

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TITLE: LABORATORY AND GROWTH CHAMBER EVALUATION OF SEED TREATMENT FUNGICIDES FOR CONTROL OF SEED-BORNE ALTERNARIA BLACKSPOT OF CANOLA, 1995

MATERIALS: ROVRAL ST (16.7% iprodione + 50% lindane)
PREMIERE PLUS (4.8% thiram + 1.6% thiabendazole + 40% lindane)
EXP-80534A (iprodione + thiram + lindane)

METHODS: Canola seed naturally infested with *Alternaria brassicae* (22% infection) was treated with fungicides at the manufacturers' recommended rates. Seed was planted 1 cm deep into a soilless mix (fine vermiculite) @ 20 seeds per 15-cm-diameter pot and watered daily with

28-14-14 fertilizer solution. There were four replications of each treatment and the pots were arranged in a completely randomized design in a growth chamber set at 16 h light/20•C and 8 h dark/10•C. Seedling emergence was taken 8 d after seeding and a seedling infection count was recorded 19 d after seeding by noting *Alternaria* infection on cotyledons.

In a Petrie plate test, the treated seed was placed on V-8 juice agar supplemented with 400 mg/L rose bengal and 300 ppm each of chloramphenicol and streptomycin sulphate. There were eight replications of each treatment arranged in a completely randomized design in an incubator set at 12 h light and 12 h dark at 24•C. An Alternaria infected seed count was recorded 9 d later.

The data were normally distributed so these were not transformed and were analysed statistically.

RESULTS: As presented in the table.

CONCLUSIONS: All the three seed treatments tested significantly ($P = 0.05$) increased emergence and gave more healthy plants than the untreated control in the growth chamber tests. In the Petrie plate test also, all the seed treatments significantly controlled the seed-borne *Alternaria*; EXP-80534A and ROVRAL ST had significantly fewer infected seedlings than PREMIERE PLUS and untreated check.

Treatment	Emergence* Growth Chamber	Infected Seedlings* Growth Chamber	% Infected Seedlings* Petrie Plates
EXP-80534A	88.8 A	6.02 B	0.0 C
Rovral ST	90.0 A	9.78 B	1.3 C
Premiere Plus	87.8 A	7.26 B	23.8 B
Control	81.8 B	23.07 A	40.0 A

* Mean of 4 replications; means within a column followed by the same letter do not differ significantly ($P = 0.05$) according to Duncan's Multiple Range Test.

#104 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 306001

CROP: Canola, spring, *Brassica napus* L., cv. Westar

PEST: Blackleg, *Leptosphaeria maculans* (Desm.) Ces. et de Not.

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TITLE: EVALUATION OF SEED TREATMENTS TO CONTROL BLACKLEG OF CANOLA

MATERIALS: Rovral ST (iprodione + lindane; 167 and 500 g ai/L), @ 30 ml/kg to provide 5 g ai iprodione/kg and 15 g ai lindane/kg; EXP-80534A (iprodione + thiram + lindane; 97, 65 and 500 g ai/L) @ 30 ml/kg to provide 3 g ai iprodione/kg, 2 g ai thiram/kg and 15 g ai lindane/kg; Premiere Plus (thiram + thiabendazole + lindane; 71, 54 and 536 g ai/L), @ 28 ml/kg to provide 2 g ai thiram/kg, 1.5 g ai thiabendazole/kg and 15 g ai lindane/kg.

METHODS: In each of the four experiments conducted, seed was surface sterilized (0.6% sodium hypochlorite, 3 min) and test products were applied to the seed; the check consisted of seed not treated with product. In experiments 1 and 3, all seed was infested with a highly virulent isolate of the fungus at the rate of 4 g seed/10 ml spore suspension (10^7 conidia/ml). Uninfested seed was used in experiments 2 and 4. After seeds were infested (experiments 1 and 3) or surface sterilized (experiments 2 and 4), test products were applied by shaking them with seed in a plastic bag. In experiment 1, 10 seeds were placed in each of 10 9-cm-diameter Petrie dishes containing potato dextrose agar (PDA) amended with chloramphenicol (50 mg/ml). The number of seedlings not producing colonies of the fungus was determined after incubation at 21•C for 9 d in the dark followed by 12 d under continuous near-ultraviolet light. In experiment 2, 2 ml of a conidial suspension (10^6/ml) was spread across the surface of chloramphenicol PDA in each Petrie dish and 10 seeds were placed in each of 10 replicate dishes. After incubation for 8 d under the same conditions as experiment 1, the number of seedlings free of fungal growth was assessed. In experiment 3, 15 seeds were placed 1 cm deep in each of 4 replicate 15-cm-diameter plastic pots filled with vermiculite. The pots were covered with plastic bags for 48 h to maintain high humidity. Plants were grown in a chamber set at 21•C, 16 h light/10•C, 8 h dark. Fertilizer solution (28-14-14; 31 g/25 L distilled water) was applied to pots daily. The number of healthy seedlings (no visible symptoms of blackleg) was determined after 22-23 d. In experiment 4, 15-cm-diameter plastic pots were filled with sterilized greenhouse soil mix. Seeds were placed on the surface of the soil (15 seeds/pot, 4 replicates/treatment) and covered with a 1-cm thick layer of perlite infested with the fungus (4 X 10^6 conidia/ml). Plants were grown under the conditions used for experiment 3 and the number of healthy seedlings was recorded after 30 d. Experiments

1, 3 and 4 were conducted twice and experiment 2 was conducted once. Experiments were analysed by analysis of variance and means were compared by least significant difference.

RESULTS: As presented in the table.

CONCLUSIONS: In experiment 1, *L. maculans* grew from all (trial 1) or most (trial 2) infested seeds in checks. All chemical treatments prevented growth of the fungus from all or most of the seeds. Rovral ST and EXP-80534A were slightly more effective than Premiere Plus. In experiment 2, the fungus grew from the medium to colonize all seeds in the check. Colonization of the seeds was suppressed to some extent by Rovral ST (45%) and EXP-80534A (43%) but scarcely at all by Premiere Plus (1%). In experiment 3, disease pressure was low in trial 1 and the number of healthy plants was high in all pots. In trial 2, disease pressure was high and all fungicide treatments were equally effective and protected most plants for the duration of the experiment. In experiment 4, plant stand was significantly increased compared to the check by Rovral ST and EXP-80534A in trial 1 (low disease pressure) and by EXP-80534A and Premiere Plus in trial 2 (high disease pressure). In the experiment most closely mimicking seedborne infection in field conditions (experiment 3), all products were equally effective under high and low disease pressure and showed no evidence of phytotoxicity. In the presence of external inoculum and severe disease pressure (experiment 4, trial 2), EXP-80534A was the most effective product.

Table 1. Effect of canola seed treatment on infection of seedlings by *L. maculans* in tests in Petrie dishes (experiments 1 and 2) and pots (experiments 3 and 4).

Trial	Seed treatment	Seedlings free of *L. maculans* (exp. 1)*	Seedlings free of *L. maculans* (exp. 2)	Healthy seedlings (exp. 3)	Healthy seedlings (exp. 4)
1	Check	0.0a**	0.0b	12.8a	8.8c
	Rovral ST	9.9c	4.5a	14.0a	13.0a
	EXP-80534A	9.0b	4.3a	14.0a	12.0ab
	Premiere Plus	8.9b	0.1b	14.5a	10.8bc
2	Check	0.3a		4.0b	1.5c
	Rovral ST	10.0c		14.0a	2.5bc
	EXP-80534A	9.7c		14.0a	10.0a
	Premiere Plus	8.3b		12.3a	5.0b

* Numbers are means of 10 seedlings/Petrie dish in experiments 1 and 2 and of 15 seedlings/pot in experiments 3 and 4.

** Means in a column within a trial followed by the same letter are not significantly different at P• 0.05 (LSD test).

#105 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Canola, cv. Westar

PEST: Blackleg, *Leptosphaeria maculans*

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TITLE: LABORATORY AND GROWTH CHAMBER EVALUATION OF SEED TREATMENT FUNGICIDES FOR CONTROL OF BLACKLEG OF CANOLA, 1995

MATERIALS: ROVRAL ST (16.7% iprodione + 50.0% lindane); VITAVAX RS (3.3% carbathiin + 6.7% thiram + 50.0% lindane); EXP-80534A (iprodione + thiram + lindane)

METHODS: Canola seed was artificially inoculated with a suspension of *Leptosphaeria maculans* conidia (4 x 10^6/ml) (Kharbanda 1992) and treated with fungicides at the manufacturers' recommended rates. Seed was planted 1 cm deep into a soilless mix (fine vermiculite) @ 20 seeds/15-cm-diameter pot and watered daily with 28-14-14 fertilizer solution. There were eight replications of each treatment. The pots were arranged in a completely randomized design in a growth chamber set at 16 h light/20• C and 8 h dark/10• C. Seedling emergence was taken 11 d later and a seedling infection count was taken 30 d after seeding by recording blackleg infection on cotyledons (Table 1).

In a Petrie plate test, infected canola seeds treated with individual fungicides were placed on potato dextrose agar, supplemented with 300 ppm each of chloramphenicol and streptomycin sulphate (Kharbanda and Werezuk 1994). There were eight replications of each treatment arranged in a completely randomized design in an incubator set at 12 h light/24• C and 12 h dark/24• C. A blackleg infected seed count was taken 20 d later (Table 1).

A second growth chamber test was conducted using uninoculated seed treated with various fungicides. Seed was planted in soil and overlaid with 1 cm thick layer of perlite infested with a virulent strain of *L. maculans* conidia (4 x 10^6/ml) (Kharbanda 1992). There were four replications of each treatment. The pots were arranged in a completely randomized design in a growth chamber set at 16 h light/20• C and 8 h dark/10• C. Seedling emergence was recorded 10 d after seeding and a seedling infection count was taken 30 days after seeding by recording blackleg infection on cotyledons and hypocotyls (Table 2).

The data were normally distributed so these were not transformed and were analysed statistically.

RESULTS: As presented in the tables.

CONCLUSIONS: All fungicidal seed treatments successfully controlled seed-borne blackleg in both growth chamber and Petrie plate tests. Vitavax RS had significantly ($P = 0.05$) less healthy seedlings than ROVRAL ST and EXP-80534A in blackleg infested perlite test. This is consistent with results of our other trials where efficacy of Vitavax RS is not demonstrable in greenhouse pot tests.

References: (1). Kharbanda P.D. 1992. Performance of fungicides to control blackleg of canola. Can. J. Plant Pathol. 14:169-176. (2) Kharbanda P.D. and S.P. Werezuk. 1994. A modified selective medium to grow bacteria-free *Leptosphaeria maculans*. Can. J. Plant Pathol. 16:77 (Abstract).

Table 1. Effectivness of fungicidal seed treatments in controlling blackleg on artificially inoculated canola seed.

Treatment	% Seedling Emergence* Growth Chamber	% Healthy Seedlings* Growth Chamber	% Infected Seeds* Petrie plates
EXP-80534A	82.5 AB	100.0 A	0.0 B
ROVRAL ST	84.4 A	100.0 A	0.0 B
VITAVAX RS	85.6 A	100.0 A	0.0 B
Control	70.6 B	82.3 B	85.0 A

* Mean of 4 replications; means within a column followed by the same letter do not differ significantly ($P = 0.05$) according to Duncan's Multiple Range Test.

Table 2. Effectiveness of fungicidal seed treatments in controlling blackleg on canola seedlings grown in perlite infested with *Leptosphaeria maculans*.

Treatment	%Seedling Emergence* Growth Chamber*	%Healthy Seedlings Growth Chamber
EXP-80534A	92.5 A	74.7 A
ROVRAL ST	91.3 A	89.5 A
VITAVAX RS	88.8 A	21.4 B
Control	93.8 A	0.0 C

* Mean of 4 replications; means within a column followed by the same letter do not differ significantly ($P = 0.05$) according to Duncan's Multiple Range Test.

#106 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 375 1221 8177

CROP: Canola, *Brassica napus* L. cv. Westar and Excel

PEST: Blackleg, *Leptosphaeria maculans*

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TITLE: EFFICACY OF ICIA-5504 AS A FOLIAR FUNGICIDE FOR CONTROL OF BLACKLEG IN CANOLA, 1995

MATERIALS: ICIA-5504 (azoxystrobin 80 WG)
PREMIERE ST (thiabendazole 1.6% + thiram 4.8% + lindane 40%)
TILT 250 EC (propiconazole 25%)
CHARGE (surfactant)

METHOD: Test sites were established in 3 areas of northern Saskatchewan where 2 year old canola stubble infested with *Leptosphaeria maculans* was abundant. Before planting the land was fertilized with maximum levels of N and P, and was treated with the pre emergence herbicide trifluralin. The seed planted in the tests was treated with PREMIERE ST at the rate of 28 ml P/kg seed. 250 seeds were planted in each row. The seed rows were 6 m long and were spaced at 15 cm. WESTAR, a cultivar highly susceptible to Blackleg, was planted at all sites. In addition, at the Saskatoon site, a second test was established using Excel, a cultivar with moderate resistance to Blackleg. The treatments were arranged in a split plot design with fungicide rate as main plot effect and surfactant as the subplot effect. The standard TILT and the untreated check were paired. Each subplot consisted of 9 rows of canola and were surrounded with 3 rows of barley to reduce interplot spore spread. The fungicides were applied at the 2 leaf stage 3 weeks after planting using a R & D plot sprayer at 276 kPa pressure and 110 L solution /ha. The surfactant CHARGE was applied at 1% of the spray volume (1.1 L/ha). Plots were rated for severity of infection using a 7 point scale based on the degree of necrosis of the cross section area of the lower stem area. A disease severity value was calculated for each plot (Pesticide Research Report 1982, p 233). Percent healthy plants was based on the number of symptomless plants in a sample. Six rows of each plot was harvested for yield determination. Yield was not done at the Rosthern site due to pod shattering from a hail storm. Data was analysed using ANOVA programs of the SAS computer software and the significance of differences among treatment means were assessed using LSD procedures.

RESULTS: Refer to the tables below. The yield data for the low disease pressure site at Saskatoon (cv Excel) had no significant differences (P = 0.05) among treatments, and is not presented.

CONCLUSIONS: In most cases ICIA-5504 did significantly reduce disease severity and disease incidence at the rates 125 and 150 g ai/ha with and without the addition of surfactant. Under the highest disease pressure the rate 100 g ai/ha also significantly reduced disease incidence and severity. A significant positive yield response occurred only at the Leask site with the rates 100 g ai/kg + S and 150 g ai/ha with and without S. The TILT treatment did not significantly reduce blackleg except for disease incidence at the Leask site.

Table 1. Data from sites with moderate to high disease pressure.

		Rosthern Site*		Saskatoon Site*		
Fungicide	Rate g ai/ha	Disease Severity	% Healthy Plants	Disease Severity	% Healthy Plants	Yield g
Azoxystrobin	50	22.3 bc**	41.8 cde	11.9 abcd	59.2 bcd	2057 ab
Azoxystrobin	50+S•	20.4 c	45.8 bcd	11.0 bcd	59.1 bcd	1926 bc
Azoxystrobin	75	17.2 cd	49.5 bc	12.4 abc	56.4 cd	1982 abc
Azoxystrobin	75+S	20.8 c	49.5 bc	11.6 abcd	58.6 bcd	2102 a
Azoxystrobin	100	21.1 c	46.2 bcd	15.5 a	51.2 d	2051 abc
Azoxystrobin	100+S	19.0 c	50.8 bc	12.0 abcd	58.1 bcd	2082 a
Azoxystrobin	125	19.9 c	45.8 bcd	9.6 cd	66.9 abc	2110 a
Azoxystrobin	125+S	18.3 cd	51.5 bc	8.0 d	70.4 a	2086 a
Azoxystrobin	150	16.7 cd	55.5 ab	8.6 cd	67.4 abc	2048 abc
Azoxystrobin	150+S	11.4 d	64.1 a	9.0 cd	68.7 ab	1900 c
Tilt	125+S	29.5 a	35.1 e	15.1 ab	48.7 d	1971 abc
Check	---	28.0 ab	36.9 de	15.6 a	48.1 d	2014 abc
Standard Error for Treatment Means		2.4	3.4	1.4	3.9	53.9

** Within a column values followed by the same letter are not significantly different according to LSD, P = 0.05.

* Canola cultivar at both sites was Westar.

• S is the surfactant CHARGE applied at 1% spray volume.

Table 2. Data from sites with low disease pressure.

Fungicide	Rate g ai/ha	Leask Site* Disease Severity	% Healthy Plants	Saskatoon Site* Yield g	Disease Severity	% Healthy Plants
Azoxystrobin	50	4.1 bc**	87.6 abcd	951 d	5.5 ab	82.2 abcd
Azoxystrobin	50+S•	3.3 bc	90.2 abcd	953 d	5.2 ab	83.4 abcd
Azoxystrobin	75	4.9 bc	85.3 bcd	1240 abc	5.1 ab	84.0 abc
Azoxystrobin	75+S	5.0 bc	83.8 cd	1231 abc	4.5ab	82.9 abcd
Azoxystrobin	100	3.0 bc	90.8 abc	1323 abc	6.6 a	76.2 cd
Azoxystrobin	100+S	2.7 c	91.6 ab	1433 ab	5.6 ab	80.5 abcd
Azoxystrobin	125	2.9 bc	90.8 abc	1217 abc	3.6 b	86.4 a
Azoxystrobin	125+S	3.3 bc	91.7 abc	1272 abc	3.5 b	85.1 ab
Azoxystrobin	150	2.5 c	93.4 a	1438 a	4.2 ab	84.2 abc
Azoxystrobin	150+S	2.7 c	92.5 ab	1387 ab	3.5 b	87.6 a
Tilt	125+S	6.7 ab	82.7 d	1180 bcd	7.0 a	76.8 bcd
Check	---	9.7 a	74.7 e	1069 cd	6.7 a	75.3 d
Standard Error for Treatment Means		1.2	2.6	68.2	1.2	3.3

** Within a column values followed by the same letter are not significantly different according to LSD, P = 0.05.

* Canola cultivar at Leask was Westar; at Saskatoon was Excel.

• S is the surfactant CHARGE applied at 1% spray volume.

#107 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 375 1221 8177

CROP: Canola, *Brassica napus* L. cv. Excel

PEST: *Rhizoctonia solani* AG-2-1

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TITLE: EFFICACY OF FLUAZINAM AS A SEED DRESSING FOR CONTROL OF RHIZOCTONIA PRE EMERGENCE DAMPING OFF AND SEED ROT

MATERIALS: FLUAZINAM 500F, VITAVAX RS (carbathiin 4.5% + thiram 9.2% + lindane 67.1%)

METHOD: Seed of canola cv Excel was treated at the rates shown in table 1 about two weeks before planting. The test site was fertilized with 100 kg N/ha and 75 kg P/ha and treated with 1 kg ai/ha triflualin about 1 week before planting. The test was designed as a randomized complete block with 4 replicates. The plots were 2 rows 6 m long at 17 cm spacing. 200 seeds were planted in each row. FURADAN at commercial rate and 200 rye grains overgrown with *Rhizoctonia solani* AG-2-1 were also added to the rows during planting. Emergence of seed in all rows were recorded three weeks after planting. Data was subjected to ANOVA and treatment means were compared by LSD procedures using SAS computer software. The results are given in the following table.

Results: The data is given in the table below.

CONCLUSION: All rates of FLUAZINAM significantly improved emergence, but not as effectively as Vitavax RS, the standard used in this test.

Table 1. Efficacy of FLUAZINAM for Rhizoctonia control.

Fungicide	Rate ml P/kg	Emergence %
Fluazinam 500F	2	47.7 b
Fluazinam 500F	3	44.2 b
Fluazinam 500F	4	45.3 b
Fluazinam 500F	5	48.3 b
Fluazinam 500F	6	49.9 b
Fluazinam 500F	10	45.5 b
Vitavax RS	22.5	57.9 a
Check	--	37.0 c
Standard Error for Treatment Mean 2.3.		

Values followed by the same letter are not significantly different according to LSD, P = 0.05.

#108 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 93000485

CROP: Corn, sweet *Zea mays* L., cv. Ultimate

PEST: Seedling blight, *Pythium* spp., *Rhizoctonia solani*, *Penicillium* spp., *Fusarium* spp., *Trichoderma* spp., *Rhizopus* spp.

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TITLE: EFFICACY OF ELEVEN SEED TREATMENT FUNGICIDES AGAINST SEEDLING BLIGHT ON SUPER SWEET CORN: I. GROWTH CHAMBER TRIALS AT BROOKS, ALBERTA, IN 1995

MATERIALS: THIRAM (thiram 42% SU); APRON-FL (metalaxyl 50% WP);
TOPSIN-M (thiophanate-methyl 70% WP); FLO-PRO IMZ (imazalil 31% SN);
MAXIM 4FS (fludioxonil 42% SU); CAPTAN 400 (captan 37.4% SU);
VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU);
THIRAM (thiram 75% WP); KODIAK CONCENTRATE (*Bacillus subtilis* 2.75% SU);
APRON-FL [UBI-2379] (metalaxyl 317 g/L SU);
CROWN [UBI-2521-1] (carbathiin 92 g/L + thiabendazole 58 g/L SU)

METHODS: This trial, which was done in cooperation with the National Sweet Corn Breeders Association (NSCBA), consisted of fifteen treatments (Table 1). Ultimate, which is moderately susceptible to seedling blight, was the cultivar selected for this study. The seedlot used was immature and highly colonized by fungi. Assays of untreated seed revealed the following levels of contamination (% seeds infested): *Rhizopus* spp. - 30.7%, *Fusarium* spp. - 14.7%, *Penicillium* spp. - 7.7%, *Aspergillus* spp. - 3.3%, and unspecified bacterial species - 1.3%. The fungicides were applied in measured amounts onto seed that was tumbled in a rotating drum. Water was added to the test products to create a slurry that was comparable to a commercial treatment rate of 591 ml of mixture/45 kg of seed (20 U.S. fl. oz./cwt.). Most of the seed was treated by University of Idaho, packaged, and sent to the Crop Diversification Centre, South (CDCS). Seed treated with THIRAM 75 WP, VITAFLO 280, CAPTAN 400, APRON-FL, and CROWN was prepared at CDCS. Naturally infested soil taken from a commercial corn field near Taber, Alberta, was dispensed into 15 cm diameter plastic pots, each holding ca. 1500 ml. The treatments consisted of four pots (replicates) with 25 corn seeds planted/pot. Seeding occurred on May 31 and the pots were arranged in a randomized complete block design in a growth chamber set at 15•C and a 12/12 h light/dark photoperiod. The trial was terminated on June 29 after one month. Data taken included emergence (no. plants/pot), and vigour and uniformity, which were subjectively rated on a scale from 1 (poor) to 5 (very good). All data were subjected to analysis of variance (ANOVA).

RESULTS: As presented in the table. Disease pressure in this trial was high, as reflected by low levels of seedling emergence. Only seed treated with THIRAM 52 S + APRON 50 W + KODIAK and THIRAM 42 S + APRON-FL produced significantly more plants than the check. None of the chemical treatments significantly improved emergence or vigour relative to the check.

CONCLUSIONS: The best-performing seed treatments were the combinations, especially those containing APRON (metalaxyl). Further work with the most promising products from this trial is warranted.

Table 1. Emergence, vigour and uniformity ratings for seedlings of Ultimate super sweet corn grown from seed treated with eleven fungicides in a growth chamber trial at Brooks, Alberta, in 1995.*

Treatment	Rate product (ml/kg seed)	Emergence** (%)	Vigour (0-5)	Uniformity (0-5)
THIRAM 42-S + APRON-50W + TOPSIN-M	3.29 ml 0.32 g 1.64 ml	28.8 ab	4.0 a	2.8 a
THIRAM 42-S + APRON-50W	3.29 ml 0.32 g	29.5 ab	2.8 b	2.3 abc
THIRAM 42-S + APRON-50W + FLO-PRO IMZ	3.29 ml 0.32 g 0.32 ml	28.2 abc	2.8 b	2.0 abc
MAXIM 4FS + APRON-50W	0.10 ml 0.32 g	26.8 abcd	3.0 ab	2.5 ab
THIRAM 42-S + APRON-50W + KODIAK	3.29 ml 0.32 g 0.32 ml	32.9 a	3.0 ab	2.5 ab
VITAFLO 280	2.80 ml	23.7 abcde	3.0 ab	2.3 abc
CAPTAN 400	2.00 ml	23.7 abcde	2.3 bcd	2.8 a
THIRAM 75 WP	2.20 g	14.7 de	2.5 bc	2.5 ab
CROWN	5.00 ml	13.0 e	1.3 d	1.3 c
APRON-FL	0.99 ml	28.5 abc	2.8 b	2.0 abc
VITAFLO 280 + APRON-FL	2.80 ml 0.99 ml	30.3 ab	2.5 bc	1.8 abc
CAPTAN 400 + APRON-FL	2.00 ml 0.99 ml	13.0 e	2.0 bcd	2.0 abc
CROWN + APRON-FL	6.00 ml 0.99 ml	15.1 cde	1.5 cd	1.5 bc

THIRAM 75 WP + APRON-FL	2.25 g 0.99 ml	37.1 a	2.8 b	2.0 abc
Untreated check	--	17.1 bcde	3.0 ab	2.8 a
ANOVA P• 0.05		s	s	s
Coefficient of Variation (%)		19.8	25.9	30.2

* The values in this table are means of four replications. Numbers within a column followed by the same small letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

** Emergence data were arcsin-transformed prior to ANOVA and the detransformed means are presented here.

#109 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 93000485

CROP: Corn, sweet *Zea mays* L., cv. Ultimate

PEST: Seedling blight, *Pythium* spp., *Rhizoctonia solani*, *Penicillium* spp., *Fusarium* spp., *Trichoderma* spp., *Rhizopus* spp.

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TITLE: EFFICACY OF ELEVEN SEED TREATMENT FUNGICIDES AGAINST SEEDLING BLIGHT ON SUPER SWEET CORN: II. FIELD TRIALS IN SOUTHERN ALBERTA IN 1995

MATERIALS: THIRAM 42-S (thiram 42% SU); APRON 50W (metalaxyl 50% WP);
TOPSIN-M 70 WP (thiophanate-methyl 70% WP); FLO-PRO IMZ (imazalil 31% SN); MAXIM 4FS (fludioxonil 42% SU); CAPTAN 400 (captan 37.4% SU);
VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU);
THIRAM 75 WP (thiram 75% WP); KODIAK CONCENTRATE (*Bacillus subtilis* 2.75% SU);
APRON-FL [UBI-2379] (metalaxyl 317 g/L SU);
CROWN [UBI-2521-1] (carbathiin 92 g/L + thiabendazole 58 g/L SU)

METHODS: This trial, which was done in cooperation with the National Sweet Corn Breeders Association (NSCBA), consisted of fifteen treatments (Table 1). Ultimate, which is moderately susceptible to seedling blight, was the cultivar selected for this study. The seedlot used was immature and highly colonized by fungi. Assays of untreated seed revealed the following levels of contamination (% seeds infested): *Rhizopus* spp. - 30.7%, *Fusarium* spp. - 14.7%, *Penicillium* spp. - 7.7%, *Aspergillus* spp. - 3.3%, and unspecified bacterial species - 1.3%. The fungicides were applied in measured amounts onto seed that was tumbled in a rotating drum. Water was added to the test products to create a slurry that was comparable to a commercial treatment rate of 591 ml of mixture/45 kg of seed (20 U.S. fl. oz./cwt.). Most of the seed was treated by University of Idaho, packaged, and sent to the Crop Diversification Centre, South (CDCS). Seed treated with THIRAM 75 WP, VITAFLO 280, CAPTAN 400, APRON-FL and CROWN was prepared at CDCS. In the field, treatments were arranged in a randomized complete block design with six replications. Each subplot consisted of a double, 6 m row, the spacing between rows was 30 cm, and the seeding rate was 33 seeds/row. Two trial sites were chosen, one in the research plot area at CDCS and the other in a commercial corn field near Taber. The trial at CDCS was seeded May 24 and the one at Taber on June 8 using a hand-driven cone seeder.

Data collected from the trials included emergence (no. plants in both rows/treatment), and vigour and uniformity, which were subjectively rated on a scale from 1 (poor) to 5 (very good). Each trial was assessed twice, once on June 15 (CDCS) and June 28 (Taber) when the corn was at the 3-4 leaf stage, and again on June 23 (CDCS) and July 7 (Taber) when it was at the 4-5 leaf stage. The emergence counts were converted to percentages and all of the data were subjected to analysis of variance (ANOVA).

RESULTS: As presented in the tables.
Brooks - All of the products tested, except CAPTAN 400 alone and CROWN, significantly improved emergence compared to the check on both dates (Table 1). The same trend prevailed with vigour ratings, but not for uniformity, where only five or six treatments proved to be significantly better than the check. Treatments containing APRON generally outperformed those without this fungicide as a component, especially in emergence and vigour.
Taber - Only VITAFLO 280, CAPTAN 400, THIRAM 75 WP and CROWN failed to significantly improve emergence relative to the check on both dates (Table 2). Seed treated with THIRAM 75 WP + APRON-FL grew the best. Too few significant differences in vigour and uniformity were seen to be of value in assessing the merits of the products under test.

CONCLUSIONS: Both trials clearly demonstrated that the newer, combination seed treatments performed better against seedling blight than the single or dual component seed treatments currently being used in Canada. The superior performance of treatments containing APRON (metalaxyl) suggested that *Pythium* species were an important component of the seedling blight complex on super sweet corn in these trials.

Table 1. Emergence, vigour and uniformity ratings for seedlings of Ultimate super sweet corn grown from seed treated with various fungicides, either singly or in combination, at Brooks, Alberta, in 1995.*

Treatment	Rate product /kg seed	Emergence** (%)		Vigour (0-5)		Uniformity (0-5)	
		June 15	June 23	June 15	June 23	June 15	June 23
THIRAM 42-S + APRON-50W + TOPSIN-M	3.29 ml 0.32 g 1.64 ml	79.9 a	80.6 a	3.0 ab	3.7 a	2.5 ab	2.8 abc
THIRAM 42-S + APRON-50W	3.29 ml 0.32 g	75.4 a	73.9 a	3.3 a	3.7 a	2.7 a	2.8 ab
THIRAM 42-S + APRON-50W + FLO-PRO IMZ	3.29 ml 0.32 g 0.32 ml	74.9 a	78.8 a	3.3 a	3.3 ab	2.4 abc	2.8 abc
MAXIM 4FS + APRON-50W	0.10 ml 0.32 g	78.0 a	77.5 a	3.1 ab	3.6 a	2.6 ab	3.1 a
THIRAM 42-S + APRON-50W + KODIAK	3.29 ml 0.32 g 0.32 ml	75.4 a	74.1 a	2.8 ab	3.3 ab	2.7 a	2.5 abcd
VITAFLO 280	2.80 ml	40.3 c	39.2 c	2.4 bcd	2.3 c	2.0 abc	2.1 bcd
CAPTAN 400	2.00 ml	35.7 cd	35.8 cd	2.1 cde	2.0 c	1.9 bc	1.8 d
THIRAM 75 WP	2.20 g	53.4 b	52.5 b	2.7 abc	3.1 ab	2.0 abc	2.3 abcd
CROWN	5.00 ml	31.1 cd	31.6 cd	1.8 de	1.8 c	2.1 abc	2.0 cd
APRON-FL	0.99 ml	74.6 a	73.6 a	2.8 ab	3.1 ab	2.3 abc	2.3 abcd
VITAFLO 280 + APRON-FL	2.80 ml 0.99 ml	77.7 a	76.3 a	2.9 ab	3.3 ab	2.1 abc	2.4 abcd
CAPTAN 400 + APRON-FL	2.00 ml 0.99 ml	72.3 a	71.6 a	2.8 ab	2.9 b	2.3 abc	2.4 abcd
CROWN + APRON-FL	6.00 ml 0.99 ml	75.2 a	74.7 a	2.8 ab	3.4 ab	2.2 abc	2.7 abc

THIRAM 75 WP + APRON-FL	2.25 g 0.99 ml	72.0 a	70.5 a	2.8 ab	3.4 ab	2.5 ab	2.8 abc
Control	--	27.5 d	26.2 d	1.8 e	1.8 c	1.8 c	1.8 d
ANOVA P• 0.05		s	s	s	s	s	s
Coeff. of Variation (%)		9.5	9.6	18.2	15.2	22.8	23.6

* The values in this table are means of six replications. Numbers within a column followed by the same small letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

** Emergence data were arcsin-transformed prior to ANOVA and the detransformed means are presented here.

Table 2. Emergence, vigour and uniformity ratings for seedlings of Ultimate super sweet corn grown from seed treated with various fungicides, either singly or in combination, at Taber, Alberta, in 1995.*

Treatment	Rate product /kg seed	Emergence** (%)		Vigour (0-5)		Uniformity (0-5)	
		June 28	July 7	June 28	July 7	June 28	July 7
THIRAM 42-S + APRON-50W + TOPSIN-M	3.29 ml 0.32 g 1.64 ml	51.7 ab	49.2 ab	2.6 ab	2.9	1.9	2.3
THIRAM 42-S + APRON-50W	3.29 ml 0.32 g	42.5 bc	40.6 b	2.3 abcd	2.8	1.8	1.9
THIRAM 42-S + APRON-50W + FLO-PRO IMZ	3.29 ml 0.32 g 0.32 ml	45.4 abc	43.2 b	2.6 ab	3.3	2.1	2.4
MAXIM 4FS + APRON-50W	0.10 ml 0.32 g	46.6 abc	45.6 ab	2.7 ab	3.1	2.2	2.3
THIRAM 42-S + APRON-50W + KODIAK	3.29 ml 0.32 g 0.32 ml	50.7 ab	48.8 ab	2.4 abcd	2.8	1.9	1.9
VITAFLO 280	2.80 ml	18.6 d	19.4 c	1.9 cde	2.3	1.6	2.1
CAPTAN 400	2.00 ml	21.1 d	19.5 c	1.4 e	2.4	1.4	2.1
THIRAM 75 WP	2.20 g	19.9 d	19.6 c	2.5 abc	3.0	2.3	2.4
CROWN	5.00 ml	18.7 d	18.2 c	2.1 bcd	2.3	1.5	1.9
APRON-FL	0.99 ml	35.0 c	35.0 b	2.3 abcd	2.6	2.0	2.3
VITAFLO 280 + APRON-FL	2.80 ml 0.99 ml	45.5 abc	47.1 ab	2.4 abcd	2.9	1.8	2.1
CAPTAN 400 + APRON-FL	2.00 ml 0.99 ml	42.0 bc	41.2 b	2.3 abcd	2.7	1.8	1.8
CROWN + APRON-FL	6.00 ml 0.99 ml	41.7 bc	42.6 b	2.5 abc	2.8	2.0	2.1

THIRAM 75 WP + APRON-FL	2.25 g 0.99 ml	58.9 a	58.1 a	2.8 a	3.2	1.8	2.3
Control	--	22.4 d	23.4 c	1.8 de	2.5	1.7	2.3
ANOVA P• 0.05		s	s	s	ns	ns	ns
Coeff. of Variation (%)		16.3	16.7	21.0	20.0	26.0	23.9

* The values in this table are means of six replications. Numbers within a column followed by the same small letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

** Emergence data were arcsin-transformed prior to ANOVA and the detransformed means are presented here.

#110 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 206003

CROP: Lettuce, cv. Ithaca

PEST: Lettuce drop, *Sclerotinia sclerotiorum* (Lib.) deBary and
Sclerotinia minor: Jagger

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TITLE: EFFICACY OF CALCIUM NITRATE FOR THE CONTROL OF SCLEROTINIA DROP OF DIRECT SEEDED LETTUCE, 1995

MATERIALS: DITHANE M-22 (maneb 80%); CALCIUM NITRATE (Ca 19%); LIME (dolomitic)

METHODS: Lettuce was direct seeded into naturally-infested soil at the Muck Research Station on July 21 in rows 42 cm apart. Plants were thinned to 30 cm within rows. A randomized complete block arrangement with 4 blocks/treatment was used. Each treatment consisted of 4 rows, 5 m in length. Agricultural LIME was applied at 3 t/ha to the soil prior to seeding. DITHANE M-22 (2.25 kg product/ha) was used as a standard treatment for comparison with three concentrations (0.01, 0.1 and 1.0% Ca) of CALCIUM NITRATE in solution, as well as an untreated control. Treatments were applied as foliar sprays 60 psi in 500 L/ha of water on August 18, 25 and September 1, 7 and 15. The trial was harvested and evaluated on October 5. The number of lettuce heads, of the 25 harvested, that were infected with Sclerotinia was assessed at harvest. Data were analysed using the General Analysis of Variance function in the Linear Models section of Statistix V.4.1.

RESULTS: As presented in table.

CONCLUSIONS: The DITHANE M-22 and LIME treatments increased the marketable weight of the heads. None of the treatments had a significant effect on the percent of heads that were diseased, or on the percentage of marketable heads.

Table 1. Evaluation of CALCIUM NITRATE, DITHANE M-22, and LIME for the control of lettuce drop.

Treatment	Percent marketable	Marketable weight (kg) (25 heads)	Percent disease
Control	66.8 a*	14.41 a	26.5 a
DITHANE M-22 (2.25 kg/ha)	61.5 a	16.73 b	35.1 a
CALCIUM 0.01%	68.2 a	14.81 a	26.6 a
CALCIUM 0.1%	74.4 a	14.74 a	21.1 a
CALCIUM 1.0%	64.6 a	13.88 a	27.5 a
LIME	62.7 a	16.73 b	32.6 a

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D.Test.

#111 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 206003

CROP: Lettuce, cv. Ithaca

PEST: Lettuce drop, *Sclerotinia sclerotiorum* (Lib.) deBary and
Sclerotinia minor Jagger

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TITLE: EFFICACY OF CALCIUM NITRATE FOR THE CONTROL OF SCLEROTINIA DROP OF TRANSPLANTED LETTUCE, 1995

MATERIALS: DITHANE M-22 (maneb 80%); CALCIUM NITRATE (Ca 19%)

METHODS: Lettuce was seeded into plug trays (128 plugs/tray) on April 12 and seedlings were transplanted on May 16, into naturally-infested soil at the Muck Research Station. Rows were 42 cm apart within row spacing was 30 cm. A randomized complete block arrangement with 4 blocks/treatment was used. Each replicate consisted of 8 rows, 5 m in length. DITHANE M-22 was used as a standard treatment for comparison with three CALCIUM NITRATE solutions, as well as an untreated control. DITHANE M-22 was applied at the rate of 2.25 kg product/ha. The three CALCIUM NITRATE solutions evaluated were 0.01% Ca, 0.1% Ca, and 1.0% Ca. Treatments were applied as foliar sprays with a Solo backpack sprayer at 60 p.s.i. in 500 L/ha of water on June 7, 15, 22 and 28. The trial was harvested and evaluated on July 5 and 6. The number of lettuce heads infected with sclerotinia was assessed at harvest. Data were analysed using the General Analysis of Variance of the Linear Models section of Statistix V.4.1.

RESULTS: As presented in table.

CONCLUSIONS: Significant differences in sclerotinia drop of lettuce were found. Application of the 0.1% solution of CALCIUM NITRATE resulted in the highest marketable yield and lowest percent disease, although these results were not significantly different from the untreated check. Treatment with 1.0% CALCIUM decreased the marketable weight compared to the DITHANE M-22 treatment. The spring weather conditions were somewhat dry resulting in low disease pressure in this trial.

Table 1. Evaluation of CALCIUM NITRATE and DITHANE M-22 for the control of lettuce drop.

Treatment	Percent marketable	Marketable weight (kg)	Percent disease
Control	81.6 ab*	74.75 ab	7.4 ab
DITHANE M-22 (2.25 kg)	78.2 b	71.95 ab	8.7 b
CALCIUM 0.01%	79.6 ab	78.08 a	8.6 b
CALCIUM 0.1%	84.9 a	80.99 a	5.2 a
CALCIUM 1.0%	83.1 ab	62.52 b	5.8 ab

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#112 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 93000484

CROP: Monarda, *Monarda fistulosa* L., cv. Morden-3
Scotch spearmint, *Mentha* x *gracilis* Sole (syn. *M. cardiaca* Baker)

PEST: Powdery mildew, *Erysiphe cichoracearum* DC.:Mérat
Rust, *Puccinia menthae* Pers.:Pers.

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TITLE: EFFICACY OF THREE FUNGICIDES AGAINST POWDERY MILDEW AND RUST ON MONARDA AND SCOTCH SPEARMINT AT BROOKS, ALBERTA, IN 1995

MATERIALS: TILT 250E (propiconazole 250 g/L EC);
NOVA 40W (myclobutanil 40% WP); BRAVO 500 (chlorothalonil 40.4% SU);
COMPANION AGRICULTURAL ADJUVANT (octylphenoxypolyethoxy-(9)-ethanol 70% SN)

METHODS: This trial was conducted in experimental plots of Monarda and Scotch spearmint at CDC-South. In the Monarda plot, the rows were spaced 1.0 m apart and the spacing between plants within rows was 0.5 m. The spearmint plot was a solid stand. Each treatment (Tables 1-2) was applied to four, 20 m^2 subplots. Each Monarda subplot contained about 40 plants. A similar set of subplots was sprayed with tap water as a check. The non-ionic adjuvant COMPANION was added to the spray mixture containing NOVA 40W at a rate of 1.0 ml/L. The treatments were arranged in a randomized complete block design with four replications. The sprays were applied with a CO_2-propelled, hand-held boom sprayer equipped with four, Tee Jet 8002 nozzles. The spray was directed onto the top and exposed sides of each row. The Monarda plants were 50 cm tall with flower buds and the spearmint plants were 8-10 cm tall on June 21 when the sprays were applied. The equivalent of 200 L/ha of spray mixture was applied to each subplot using a boom pressure of 275 kPa. Symptoms of powdery mildew and rust were not seen in either crop on this date. Each fungicide was applied only once, except for one BRAVO treatment where a second spraying was done on June 30. Rust and mildew were evident on the Monarda at this time, as was rust on the spearmint.

From August 1-9, visual ratings of mildew and rust severity were made by collecting 25 stems of approximately the same size from each subplot of both crops and counting the number of leaves with mildew and/or rust per stem. These counts were converted to percentages, arcsin-transformed where necessary, and subjected to analysis of variance (ANOVA). Rust severity was rated on the spearmint using the following scale: clean (0) = no rust, slight (1) = 1-10% leaf area diseased, moderate (2) = 11-25%, severe (3) = 26-50%, and very severe (4) = >50%. Samples were collected from the spearmint subplots where BRAVO 500 had been applied and these plants, along with samples of the check, were frozen pending residue analysis.

RESULTS: As presented in the tables.
Monarda - The levels and uniformity of powdery mildew and rust infection in this trial ranged from moderate to very high, respectively (Table 1). All of the fungicides significantly reduced mildew incidence on the upper leaf surface relative to the check, but no single treatment was superior. An interesting but unexplained anomaly was the high incidence of mildew on the lower surface of leaves receiving two versus one application of BRAVO. Rust was not controlled by any of the chemicals tested under the heavy disease conditions of this trial.
Spearmint - Very little mildew was observed on the plants, but levels of rust were generally high (Table 2). Although TILT 250E (1.00 L/ha) markedly reduced the incidence of rust, neither this treatment nor any of the others had significantly less disease than the check.

CONCLUSIONS: Overall, TILT 250E appeared to provide the best control of powdery mildew on Monarda and rust on spearmint under the conditions of these trials. Further work is required to identify the rates and frequency of applications that will provide effective control of these diseases.

Table 1. Incidence of powdery mildew and rust on Monarda sprayed with three fungicides at Brooks, Alberta, in 1995.*

Treatment	Rate (product/ha)	Mildewed leaves (%)**		Rusted leaves (%)
		Upper surface	Lower surface	
TILT 250E	0.50 L	9.5 a	0.6 a	100.0
TILT 250E	1.00 L	12.3 a	2.9 a	99.7
NOVA 40W	0.25 kg	14.3 a	3.7 a	94.0
BRAVO 500	1.17 L	17.5 a	5.8 a	99.7
BRAVO 500 (2 applications)	1.17 L	21.3 a	18.3 b	95.1
Untreated check	--	39.0 b	17.1 b	99.7
ANOVA P• 0.05		s	s	ns
Coefficient of Variation (%)		25.7	43.1	6.1

* The values in this table are the means of four replications. Numbers in a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

** These data were arcsin-transformed prior to ANOVA and the detransformed means are presented here.

Table 2. Incidence and severity of rust in Scotch spearmint sprayed with three fungicides at Brooks, Alberta, in 1995.*

Treatment	Rate (product/ha)	Rusted leaves	
		Incidence (%)**	Severity (0-4)
TILT 250E	0.50 L	79.1	1.2
TILT 250E	1.00 L	34.1	1.0
NOVA 40W	0.25 kg	80.5	1.3
BRAVO 500	1.17 L	79.3	1.3
BRAVO 500 (2 applications)	1.17 L	54.1	1.1
Untreated check	- -	78.1	1.3
ANOVA P• 0.05		ns	ns
Coefficient of Variation (%)		27.2	28.7

* The values in this table are the means of four replications.

** These data were arcsin-transformed prior to ANOVA and the detransformed means are presented here.

#113 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 206003

CROP: Onion, Yellow cooking, cv. Benchmark

PEST: Botrytis leaf blight, *Botrytis squamosa* Walker

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TITLE: EFFICACY OF FOUR FORMULATIONS OF BRAVO AND BRAVO PLUS RIDOMIL, FOR CONTROL OF BOTRYTIS LEAF BLIGHT

MATERIALS: BRAVO 720 (chlorothalonil 54%); BRAVO ULTREX (chlorothalonil 82.5%); IB11953 (chlorothalonil); BRAVO ZN (chlorothalonil 40.4%); RIDOMIL 240 EC (metalaxyl 2.5%)

METHODS: Onions were seeded into organic soil at 38 seeds/m in rows 42 cm apart at the Muck Research Station on May 4, 1995. A randomized complete block arrangement with 4 blocks/treatment was used. Each replicate consisted of 8 rows, 5 m in length. BRAVO ULTREX, IB11953 and BRAVO ZN were applied singly and BRAVO 720 and Ridomil 240 EC were tank mixed at the following rates. BRAVO 720 1.4 L/ha, BRAVO ULTREX 1.2 kg/ha, IB11953 1.2 kg/ha, BRAVO ZN 2 L/ha, RIDOMIL 240 EC 0.84 L/ha. An untreated check was also included. Treatments were applied on July 24, August 1,8,15,22 1995 as foliar sprays at 90 p.s.i., with a D2 solid cone nozzle in 300 L of water. Twenty-five plants per replicate were harvested when near maturity on August 24, 1995. The three lowest leaves on each plant with approximately 80% or more non-necrotic tissue were rated for percentage of green leaf area using the Manual of Assessment keys for Plant Diseases by Clive James, Key No 1.6.1. The number of green and dead leaves was also recorded. Data was analysed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1.

RESULTS: As presented in table.

CONCLUSIONS: All fungicide treatments reduced the average number of dead leaves per plant. Treatments did not have a significant effect on the number of green leaves per plant nor the percent of green tissue.

Table 1. Evaluation of BRAVO 720 Ridomil 240 EC., BRAVO ULTREX, IB11953, BRAVO ZN for the control of Botrytis leaf blight.

Treatment	Rate kg (product/ha)	Percent green tissue	Average no. dead leaves/ plant	Average no. green leaves/ plant
BRAVO 720 +	1.4			
RIDOMIL 240 EC	0.84	82.50 a*	3.57 b	5.91 a
BRAVO ULTREX	1.2	85.00 a	2.93 b	5.78 a
IB11953	1.2	83.75 a	3.00 b	5.96 a
BRAVO ZN	2.0	85.00 a	3.53 b	5.59 a
Check		81.25 a	4.51 a	5.10 a

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#114 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 206003

CROP: Onion, Yellow cooking, cv. Benchmark

PEST: Botrytis leaf blight, *Botrytis squamosa* Walker

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TITLE: EFFICACY OF TWO FORMULATIONS OF PENNCOZEB FOR CONTROL OF BOTRYTIS LEAF BLIGHT OF ONION

MATERIALS: PENNCOZEB 75 DF (mancozeb 75%); PENNCOZEB 75 DF (mancozeb 75%); ROVRAL (iprodione 50%)

METHODS: Onions were seeded (36 seeds/m) into organic soil at the Muck Research Station on May 4, 1995. A randomized complete block arrangement with 4 blocks/treatment was used. Each replicate consisted of 8 rows (42 cm apart), 5 m in length. PENNCOZEB 75 DF and PENNCOZEB 75 DF + ROVRAL were applied singly at the following rates: 3.25 kg/ha, 2.25 kg/ha and 0.75 kg/ha respectively. An untreated check was also included. Treatments were applied on July 24 and August 1, 8, 15, 22, 1995 as foliar sprays at 90 p.s.i. in 300 L of water with a solid cone D2 nozzle. Twenty five plants per replicate were harvested on August 24, 1995 when plants were near maturity. The three lowest leaves on each plant with approximately 80% or more non-necrotic tissue were rated for percentage of green leaf area using the Manual of Assessment Keys for Plant Diseases by Clive James, Key No. 1.6.1 The number of green leaves and dead leaves was also recorded. Data were analysed using the General Analysis of Variance function of the Linear Models section of Statistix V. 4.1.

RESULTS: As presented in table.

CONCLUSIONS: The fungicide applications increased the average number of green leaves per plant in comparison to the untreated check. Treatments did not have an effect on the average number of dead leaves per plant nor the percent of green leaf tissue.

Table 1. Evaluation of PENNCOZEB 75 DF and PENNCOZEB 75 DF + ROVRAL for the control of Botrytis leaf blight on the three oldest green leaves.

Treatment	Rate kg (product/ha)	Percent green tissue	Average no. dead leaves/ plant	Average no. green leaves/ plant
PENNCOZEB 75 DF	2.45	82.50 a	3.57 a	5.91 ab
PENNCOZEB 75 DF +	2.25	78.75 a	3.34 a	6.11 a
ROVRAL	.75			
Check		81.25 a	4.51 a	5.10 b

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#115 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 206003

CROP: Onion, Yellow cooking, cv. Fortress and Taurus

PEST: Onion smut, *Urocystic cepulae* Frost

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TITLE: EVALUATION OF FUNGICIDE SEED TREATMENTS FOR THE CONTROL OF ONION SMUT, 1995

MATERIALS: PRO-GRO (carbathin 30% + thiram 50%); Methyl cellulose; BAYTAN (triadimenol 32%); RAXIL (tebuconazole 8%); PRO-GRO LIQUID (Vitavax 17%, thiram 28%)

METHODS: Raw onion seed was treated with several fungicides. PRO-GRO was applied at 25 g of product/kg of seed, 25 g applied with 1% methyl cellulose per kg of seed, or 44 ml of the liquid formulation/kg of seed. BAYTAN was applied at 4.73 ml + 5.27 ml of water or 9.46 ml + 0.54 ml of water/kg seed. RAXIL was also applied to raw seed at rates of 18 and 36 ml/kg of seed. An untreated check was also included. The trial was seeded on May 5 and 6 in naturally infested soil at the Muck Research Station. A randomized complete block arrangement with 4 blocks/replicate was used. Each replicate consisted of 2 rows of cv. Fortress and 2 rows of Taurus, 5 m in length. The treatments were seeded using a V-belt push seeder delivering a random spacing and a depth of 1.5 to 2.0 cm. Germination counts were taken every 2 d starting May 24 and ending June 5 from a 1 m section of each row. When the onions reached 1 true leaf, a 1 m section was harvested, washed and evaluated for incidence of smut on June 14. Other 1 m samples were taken on June 22 and July 7. A final evaluation of smut was made at harvest on September 19. The harvest weight was the sum of cv. Fortress and Taurus, taken from the remaining 16 m of onions on September 20. Data was analysed using the General Analysis of Variance section of the Linear Models function of Statistix, V.4.1.

RESULTS: As presented in tables.

CONCLUSIONS: Fungicides PRO-GRO and BAYTAN reduced smut infection on onions except when onions were assessed at harvest (September 19) and in Fortress onions assessed on June 14. The high rate of RAXIL reduced smut on cv. Taurus but not on cv. Fortress. PRO-GRO + methyl cellulose and the high rate of BAYTAN were most effective. The percent of onions infected by smut generally declined as the season progressed because several of the infected onions died prior to harvest. All treatments except the low rate of RAXIL increased onion yields compared to the untreated Check.

Table 1. Evaluation of PRO-GRO, BAYTAN and RAXIL on onion smut on cv. Fortress.

Treatments	Percent Infected with Smut			
Fortress	June 14	June 22	July 7	Sept. 19
Check	73.5 a	43.8 d	48.1 b	0.0 a
PRO-GRO 25 g/kg	63.5 a	19.8 ab	48.3 b	0.0 a
PRO-GRO + Methyl Cellulose 25 g/kg	63.1 a	17.4 a	23.7 a	0.0 a
Liquid PRO-GRO 44 ml/kg	61.4 a	26.7 abc	49.5 b	0.0 a
BAYTAN + water 4.73 ml + 5.27 ml/kg	60.3 a	31.0 cd	34.6 a	0.0 a
BAYTAN + water 9.46 ml + 0.54 ml/kg	50.9 a	15.5 a	25.3 a	0.0 a
RAXIL 18 ml/kg	73.4 a	36.8 cd	51.0 b	2.25 b
RAXIL 36 ml/kg	69.5 a	33.7 bcd	45.7 b	1.3 ab

Table 2. Evaluation of PRO-GRO, BAYTAN, RAXIL on onion smut on cv. Taurus.

Treatments	Percent Infected with Smut			
Taurus	June 14	June 22	July 7	Sept. 19
Check	82.3 d	68.8 e	61.3 e	0.0 a
PRO-GRO 25 g/kg	56.8 abc	28.8 b	26.6 ab	1.3 a
PRO-GRO + Methyl cellulose 25 g/kg	51.2 a	17.9 ab	20.5 a	0.0
Liquid PRO-GRO 44 ml/kg	56.2 ab	26.9 ab	32.2 abc	0.0 a
BAYTAN + water (4.73 ml + 5.27 ml/kg)	70.9 bcd	23.5 ab	45.8 cde	2.3 a
BAYTAN + water (9.46 ml + 0.54 ml/kg)	50.9 a	13.4 a	17.7 a	1.3 a
RAXIL 18 ml/kg	78.6 d	57.3 de	55.6 de	0.0 a
RAXIL 36 ml/kg	73.5 cd	44.3 cd	41.1 bcd	1.8 a

Table 3. Yield data in bushels per acre of Fortress and Taurus together.

Treatments	Rate/kg seed	Yield B/A
Check	----	386 d
PRO-GRO	25 g	632 abc
PRO-GRO + Methyl cellulose	25 g	707 ab
Liquid PRO-GRO	44 ml	739 a
BAYTAN + water	(4.73 ml + 5.27 ml)	598 abc
BAYTAN + water	(9.46 ml + 0.54 ml)	716 ab
RAXIL	18 ml	488 cd
RAXIL	36 ml	637 abc

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#116 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 206003

CROP: Onions, cv.

PEST: White rot, *Sclerotium cepivorum* Berk.

NAME AND AGENCY:
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TITLE: EVALUATION OF DIALLYL DISULPHIDE (DADS) AND N-PROPYL DISULPHIDE (DPDS) FOR CONTROL OF SCLEROTIAL POPULATIONS OF THE WHITE ROT PATHOGEN IN MUCK SOILS

MATERIALS: Two sclerotium germination stimulants: DADS (diallyl disulphide mixture 85.5%, diallyl sulphide 4.5%) and DPDS (n-propyl disulphide 88%, related compounds, 2%) provided by United Agri-Products, R.R. 2, Dorchester, Ontario, N0L 1G5

METHODS: Onions (cv. Eskimo or Norstar) were assessed for incidence of white rot on July 28, August 25 and September 1st, 1995 in three commercial onion fields which had been established in May 1994 in the Holland Marsh. Onions in these fields were grown in rows 42 cm apart. At Site 1 onions were grown from transplants (30/m). At the other sites, onions were seeded at approx. 33/m. These sites had known histories of white rot and had been treated at site 1 (June 27, 1994) with DADS, and with both DADS and DPDS at sites 2 and 3 (August 17, 1994), with untreated areas as the checks. DADS had been applied at a rate of 5 L/ha at site 1 (approx. 0.1 ha) and both DADS and DPDS at a rate of 10 L/ha at the other two sites (approx. 0.3 ha). The germination stimulants were applied to depths of 10 and 20 cm using a Vorlex soil fumigation apparatus which had eleven injection hoses spaced 20 cm apart. Treatments were replicated 4 times at site 1, and arranged as a randomized complete block design with six replications at sites 2 and 3. The percentage of onions with symptoms of white rot were assessed from six subplots each 1 m x 1 row in each of the four replicates at site 1, and from four subplots each 1 m x 4 rows in each of the six replicates at sites 2 and 3. Data were analysed using the General Analysis of Variance function of the Linear Models section of Statistix V. 4.1.

RESULTS: As presented in table.

CONCLUSIONS: Incidence of white rot was low at all sites, however, differences were found between the DADS treatments and untreated checks at site 1 and 2. There was no indication of differences between the DPDS treatments and the untreated checks.

Table 1. Evaluation of DADS and DPDS for control of sclerotial populations of *Sclerotium cepivorum* in muck soils.

Treatment	Incidence of White Rot (%)		
	Site 1	Site 2	Site 3
DADS	2.23 a*	0.17 a	13.2 a
DPDS	---	0.33 ab	9.2 a
Check	7.87 b	1.45 b	13.7 a

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#117 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 206003

CROP: Onion

PEST: White rot, *Sclerotium cepivorum* Berk.

NAME AND AGENCY:
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TITLE: FIELD EVALUATION OF ONION LINES FOR RESISTANCE TO THE WHITE ROT PATHOGEN, *SCLEROTIUM CEPIVORUM* BERK

MATERIALS: Onion breeding lines obtained from Dr. I.L. Goldman at the University of Wisconsin, Petoseed, Asgrow Ltd., and two commercial cultivars Norstar and Fortress.

METHODS: Plots were established in three fields with known histories of white rot in the Holland Marsh. Onions were seeded in rows 42 cm apart and thinned to 40/m. The plot size for each onion line at all sites was 1 m x 4 rows. Seeds from each resistant line, as well as the two commercial cultivars Norstar and Fortress, were seeded on May 2nd at sites 1 and 2 and May 3rd and 4th at site 3. Each line was replicated four times and arranged in a randomized complete block design. All onions in each plot were assessed for incidence of white rot in the field on August 28th (site 1), September 5th (site 2) and September 18th (site 3), 1995. Data were analysed using the General Analysis of Variance function of the Linear Models section of Statistix, V. 4.1.

RESULTS: As presented in table.

CONCLUSIONS: Despite the fact that the incidence of white rot was relatively high at site 1 and low at site 3, all the results indicated that the onion lines could be divided into two main groups with different levels of white rot. These two groups consisted of the onions from the University of Wisconsin (W) including the two commercial lines, and the onions from Asgrow (XPH). In general the lines from Petoseed (PSR) were not different from either the Asgrow or the Wisconsin lines, except at site 2 in which PSR459294 had the highest incidence of white rot. The onion lines XPH 15055, XPH 15057, XPH15058 and XPH15059 had higher incidence of white rot compared to the other lines at all three sites. The commercial line, Norstar, had very low levels of white rot at all three sites, however, this cultivar was present in very small numbers compared to the other onion lines at the 3 sites. This may have been due to low seeding of the onions in spring, or possible loss of the onions early in the season due to pests and diseases such as onion maggot and white rot.

Table 1. Incidence of white rot in resistant onion lines grown at three commercial sites in 1995.

Onion line	Incidence of white rot (%)		
	Site 1	Site 2	Site 3
PSR459294	16.7 abc	24.0 a	0.9 d
XPH15057	21.5 a	14.7 ab	3.1 ab
PSR459194	12.8 b-f	13.8 bc	0 d
XPH15055	17.9 ab	13.3 bc	1.7 bc
XPH15058	10.6 b-f	11.9 bcd	1.5 bc
PSR459094	10.7 b-f	10.9 b-e	---
XPH15056	12.9 b-f	7.7 b-f	0 d
PSR459394	10.8 b-f	7.6 b-f	2.4 bc
XPH15059	13.7 a-e	7.1 b-f	6.3 a
PSR459494	10.3 b-f	7.0 b-f	---
PSR459694	13.8 a-e	5.6 b-f	0 d
W459	5.7 ef	4.8 c-f	---
PSR459594	14.8 a-d	4.4 c-f	---
FORTRESS	9.1 c-f	3.3 def	0 d
W458	---	2.9 def	---
PSR458994	11.3 b-f	2.3 def	0 d
W454B	6.5 ef	1.6 ef	---
904-95	---	0.3 f	1.2 d
W456B	5.3 f	0 f	0 d
W457B	7.8 def	0 f	0 d
W58B	13.8 a-e	0 f	0 d
W59B	6.7 def	0 f	---
NORSTAR	5.3 f	0 f	0 d

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#118 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 206003

CROP: Onion

PEST: White rot, *Sclerotium cepivorum* Berk.

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TITLE: SCREENING ONION LINES FOR RESISTANCE TO *Sclerotium cepivorum* BERK. USING A SCALE INOCULATION TECHNIQUE

MATERIALS: Onion breeding lines obtained from Dr. I.L. Goldman at the University of Wisconsin, Petoseed, Asgrow Ltd., and two commercial cultivars Norstar and Fortress. *Sclerotium cepivorum* isolates MCG-1, 1-9 and MCG-2, 3-6.

METHODS: Twenty-five onion lines including two commercial varieties, Norstar and Fortress, were used in this study. Segments of onion scales were prepared for inoculation by a method adapted from Miyaura *et al* (1985). The outer dry scales were removed from mature bulbs which were then surfaced disinfected in a 10% solution of commercial bleach for 5 min and rinsed in two lots of sterile distilled water. Onions were allowed to air dry for 30 min after which scale segments of approximately 5 x 5 cm were cut from the 2nd, 3rd or 4th scale segments of each bulb (outer dry or thin green scales were discarded). The inner membrane of each onion scale was removed and the segment placed hollow side up on a previously sterilized perforated plastic tray. Each scale was labelled on the underside with a permanent marker. Two isolates of *Sclerotium cepivorum* were tested based on two distinct mycelial compatibility groups (MCG-1, 1-9 and MCG-2, 3-6) present in the Holland Marsh (Earnshaw, 1994). The isolates were grown on potato dextrose agar one week prior to inoculation. Agar discs 5 mm in diameter were cut from the margins of actively growing cultures of each isolate with a sterile cork borer and placed mycelial side down in the centre of each segment. Each line was replicated four times and arranged in a randomized complete block design. Each replication was arranged in one plastic tray and the trays stacked in a plexiglass chamber (1.5 m x 60 cm x 60 cm) previously filled up to 7.5 cm with water to maintain high humidity. The plexiglass chamber was covered with a black sheet for 5 d, then the diameter of lesion formed on the underside of each scale (convex side) was measured using a clear plastic ruler. A thermograph was placed beside the chamber and underneath the sheet to monitor temperature for the duration of the experiment. Data were analysed using the General Analysis of Variance function of Linear Models section of Statistix, V. 4.1.

RESULTS: As presented in table for the two isolates of *S. cepivorum*.

CONCLUSIONS: There was a high correlation between lesion diameters formed by the two *S. cepivorum* isolates, MCG-1, 1-9 and MCG-2, 3-6 (0.79, P = 0.05). Pearson's correlation coefficient), on the 23 onion lines screened. Lesion diameters ranged from 9.5 mm - 23.5 mm for both isolates, however, there were no major differences among lines in response to the pathogen. The line W454B from the University of Wisconsin and XPH15058 from Asgrow showed the smallest lesions (9.5 mm - 11.5 mm) for both isolates. The largest lesions were found on three lines from Petoseed PSR459694, PSR459194 and PSR459494 for the MCG-1 isolate, and W459B (Wisconsin), PSR459094 and PSR459194 (Petoseed) for the MCG-2 isolate. There was also a variation in lesion diameters between two Norstar onions and two Fortress onions (1 and 2) from 13 mm - 20 mm for the isolate MCG-1, however, these lesion sizes were not significantly different from one another. This experiment will be repeated at least once to confirm the results.

Table 1. White rot resistant variety plexiglass trial 1995.

Onion line	Diameter of Lesion (mm) MCG-1,1-9*	 MCG-2,3-6
PSR459694	23.5 a	19.0 a-f
PSR459194	21.5 ab	21.2 abc
PSR459494	21.0 ab	15.2 a-g
XPH15055	20.2 abc	20.5 a-d
FORTRESS1	20.0 a-d	19.5 a-e
W458	19.5 a-e	19.8 a-e
W459B	19.5 a-e	23.5 a
PSR459094	19.0 a-f	23.0 a
NORSTAR1	19.0 a-f	15.8 a-g
PSR459594	18.8 a-f	19.5 a-e
XPH15057	18.2 a-g	21.0 abc
XPH15059	18.2 a-g	20.5 a-d
PSR458994	17.0 a-h	12.2 c-g
W458B	16.2 b-h	18.0 a-g
PSR459294	16.0 b-h	16.8 a-g
PSR459394	15.8 b-h	16.8 a-g
W457B	15.5 b-h	12.5 c-g
XPH15056	15.2 b-h	11.0 efg
W459	14.5 b-h	13.0 b-g
FORTRESS2	13.5 c-h	11.2 d-g
NORSTAR2	13.0 d-h	15.5 a-g
904-95	12.8 e-h	22.2 ab
116-93	12.2 f-h	15.0 a-g
W454B	11.5 gh	9.5 g
XPH15058	10.0 h	10.0 fg

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Waller-Duncan Baysian K-ratio.

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Kuniaki M., Shinada, Y. and Gableman, W.H. 1985. Selection for resistance of onions to *Botrytis allii* by scale inoculation method. Hort. Sci. 20:769-770.

#119 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 362-1221-8801

CROP: Pea, field, cv AC Tamor & Radley

PEST: Ascochyta blight, *Ascochyta spp.*

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TITLE: EFFECT OF SEED TREATMENT ON SEEDBORNE ASCOCHYTA IN FIELD PEA, 1995

MATERIALS: Captan 50% WP (N-(trichloromethyl)thio-4-cyclohexene-1,2-dicarboximide); Rovral 4F 50% (iprodione); Thiram 75% WP; Aliette 40% WP (fosetyl-Al 40%); Crown (carbathiin + thiabendazole 15%); Vitaflo 280 28% (carbathiin + thiram); Apron 30% (metalaxyl)

METHODS: This experiment was conducted at the Research Centre at Morden, Manitoba in 1995. Two seedlots each of the field pea (*Pisum sativum* L.) cultivars AC Tamor and Radley were used; one seedlot had high and the other had low level of seedborne infection. A split-plot experimental design was used with seedlots as main plots and seed treatments as sub-plots, in four replicates. Plots consisted of four rows 3 m long with 0.30 m spacing between rows and 1.2 m between plots. Fifty seeds were planted in each row.

The seedlots were treated 2 d prior to seeding. Fungicide treatments with rates (g or ml a.i./kg of seed) as follows: 1 = Control, 2 = Thiram (1.0), 3 = Crown (6.0) + Apron (0.17), 4 = Crown (3.0) + Apron (0.17), 5 = Crown (1.5) + Apron (0.17), 6 = Crown (0.75) + Apron (0.17), 7 = Vitaflo280 (3.3) + Apron (0.17), 8 = Thiram (1.0) + Apron (0.17), 9 = Apron (0.17), 10 = Crown (6.0), 11 = Vitaflo280 (3.3), 12 = Rovral 4F (1.24), 13 = Thiram (1.0) + Rovral (1.24), 14 = Thiram (0.5) + Rovral 4F (0.62), 15 = Thiram (0.5) + Rovral 4F (1.24), 16 = Thiram (0.75) + Rovral 4F (0.93), 17 = Aliette (2.5), 18 = Aliette (2.5) + Rovral (1.24)., 19 = Captan (2.5). Seeding was done on June 1, and harvesting was completed on August 31, 1995. Plant emergence was recorded. Plants were dug out from one outer-row of each plot after emergence, and roots were assessed for signs of infection on a scale of 1 to 5; 1 = healthy, 2 = very small lesions or light browning, 3 = 2-3 mm lesions on stems or moderate browning, 4 = 3-5 mm long lesions or dark browning, and 5 = lesions girdling stems or dead seedling. Plants were dug out from the second outer-row of each plot before flowering and were assessed for root infections. The remaining two inner-rows were harvested at plant maturity (10% moisture content) for seed yield at the end of the season.

RESULTS: Analysis of variance showed significant (P = 0.05) differences for the treatments with no significant cultivar x treatment interaction. Emergence was higher and disease index was lower in the seedlots with low infection level than the seedlots of high infection level in both cultivars. The results from the four seedlots are summarized in Table 1. All seed treatments, except for treatment No. 12, significantly (P = 0.05) improved emergence of the infested seed lots. Most treatments significantly reduced the foot rot disease severity, and increased yield up to 23% of the control plots.

CONCLUSIONS: The most effective treatments in improving emergence, reducing disease severity, and improving yield are the following: No. 5, Apron in combination with Crown; No.9, Apron; Nos. 13 and 14, Rovral 4F in combination with Thiram; No. 17, Aliette, and No. 19, Captan.

Table 1. Effect of seed treatment with several fungicides on emergence, disease index, and yield of field pea in Manitoba in 1995.

Treatment No. & Fungicide	Emergence %	Disease Index	Yield (kg/ha)
1 Control	63*	1.45	4310
2 Thiram	77	1.39	4810
3 Crown 8X + Apron	83	1.17	4960
4 Crown 4X + Apron	85	1.25	4910
5 Crown 2X + Apron	84	1.23	5300
6 Crown 1X + Apron	84	1.30	4880
7 Vitaflo280 + Apron	83	1.30	5060
8 Thiram + Apron	80	1.50	4680
9 Apron	79	1.47	5200
10 Crown	75	1.34	4730
11 Vitaflo280	79	1.26	4690
12 Rovral 4F	63	1.41	4570
13 Rovral 4F + Thiram (1:1)	78	1.25	5180
14 Rovral 4F + Thiram (.5:.5)	76	1.27	5210
15 Rovral 4F + Thiram (.5:1)	80	1.35	4670
16 Rovral 4F + Thiram (.75:.75)	77	1.22	4980
17 Aliette	78	1.23	5200
18 Aliette + Rovral 4F	78	1.21	4990
19 Captan	77	1.26	5090
LSD (P = 0.05)	4	0.10	445

* Values are the means of four replicates from the two seed lots each of the cultivars AC Tamor and Radley.

#120 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61009653

CROP: Pea, field, *Pisum sativum* L., cv. Patriot

PEST: Mycosphaerella blight, *Mycosphaerella pinodes* (Berk. & Blox.)

NAME AND AGENCY:

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TITLE: EFFECT OF SPRAY SCHEDULING OF BRAVO FOR CONTROL OF MYCOSPHAERELLA BLIGHT OF FIELD PEA

MATERIALS: BRAVO 500 F (chlorothalonil 500 g/L su)

METHODS: Field plot experiments were conducted at two sites, Mundare and Morinville, Alberta in the spring of 1995. Both fields had a severe mycosphaerella blight in 1994. A pre-emergence herbicide, Edge F (ethalfluralin 50%), was incorporated into the soil at a rate of 1.6 kg/ha along with 60 kg/ha fertilizer (8-36-15-5, N-P-K-S). Field pea cv. Patriot was planted 4 cm deep on 5 May and 9 May at Mundare and Morinville, respectively, with a grain drill at 20 g seeds/row. A peat-based inoculant (Enfix-P^{TM}) at 30 ml/row was used as a source of root-nodulating bacteria. Each plot consisted of four, 6 m rows, with a 30 cm row spacing. Adjacent plots were separated by 1 m and replicate plots by 2 m. The experiment was arranged in a randomized complete block with four replicates.

Application of Bravo was made at three different growth stages: early flowering on July 6 and 10 (early spray), early podding on July 17 and 26 (mid-spray), and podding on July 25 and August 4 (late spray) at Mundare and Morinville, respectively. Bravo was sprayed either once, twice or three times depending on the spray schedule. There were ten treatments: early spray at two rates, mid-spray, early plus mid sprays at two rates, early plus late sprays, mid plus late sprays at two rates, early plus mid plus late sprays at two rates, and an untreated control. Bravo was applied at a recommended water volume (1000 L/ha) for each spray. Plots were assessed for symptoms of *Mycosphaerella pinodes* infection three weeks after the final application. Symptoms were visually estimated as the percent of foliage area infected using a 0 - 10 scale where 0 = no infection, 1 • 10%, 2 = 11-20%, 3 = 21-30%, 4 = 31-40%, 5 = 41-50%, 6 = 51-60%, 7 = 61-70%, 8 = 71-80%, 9 = 81 - 90% and 10 = 91- 100% of leaf area affected. At maturity, plants from each plot (4 m^2) were swathed and combined. Seeds were dried to 16% moisture content and weighed.

RESULTS: Results of scheduled spraying of Bravo on the control of mycosphaerella blight of field pea at two sites, Mundare and Morinville, in 1995 are summarized in Table 1. All Bravo treatments significantly reduced the severity of mycosphaerella blight at both sites, with the exception of early and mid sprays at Mundare. Application of Bravo twice or three times resulted in the least disease, with severity ratings from 4.3 to 5.3 and from 3.8 to 4.8 for Mundare and Morinville, respectively. The disease severity of a single application of Bravo ranged from 6.8 to 7.3 and from 5.8 to 6.5 for Mundare and Morinville, respectively. No significant differences occurred in seed yield for all Bravo treatments at either site, but the greatest seed yield was observed when Bravo was applied at three different growth stages.

CONCLUSIONS: Based on results obtained at two locations in Alberta, Bravo was effective in reducing the severity of mycosphaerella blight. Disease severity with two or three sprays was significantly lower than a single spray or the control. No differences in seed yield were observed between various spray schedules with Bravo; however, spraying at three growth stages appeared to increase yield the most.

Table 1. Effect of scheduled sprays of Bravo on severity of mycosphaerella blight and seed yield of field pea.

Treatment	Rate (kg a.i./ha)	Disease severity**		Yield (kg/ha)	
		Mundare	Morinville	Mundare	Morinville
Control	0	8.5 a*	8.0 a	1303	818
Early spray	3.1	7.3 ab	6.0 bc	1670	1015
Early spray	4.0	6.8 b	5.8 bcd	1545	998
Mid-spray	3.1	7.3 ab	6.5 b	1790	995
Early plus mid sprays	2.0	5.3 c	4.8 cde	1775	958
Early plus mid sprays	3.1	5.0 c	4.5 de	1683	1025
Mid plus late sprays	2.0	5.3 c	4.5 de	1683	1140
Mid plus late sprays	3.1	4.8 c	4.5 e	1533	1065
Early plus mid plus late sprays	2.0	4.8 c	4.0 e	1740	1098
Early plus mid plus late sprays	3.1	4.3 c	3.8 e	2028	1218
ANOVA P• 0.05		s	s	ns	ns

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P• 0.05).

** Severity rating scale: 0 = clean, 1 • 10%, 2 = 11-20%, 3 = 21-30%, 4 = 31-40%, 5 = 41-50%, 6 = 51-60%, 7 = 61-70, 8 = 71-80%, 9 = 81 - 90% and 10 = 91- 100% of leaf area infected.

#121 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 362-1241-9402

CROP: Pea, field, cv. Radley and AC Tamor

PEST: Mycosphaerella blight, *Mycosphaerella pinodes* (Berk. & Bloxam)

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TITLE: EFFECT OF TIME AND FREQUENCY OF BRAVO APPLICATIONS ON YIELD OF FIELD PEAS - 1995

MATERIALS: BRAVO (Chlorothaloil 50%)

METHODS: The field experiment was conducted at Morden in 1995. Field pea (*Pisum sativum* L.) cultivars AC Tamor and Radley were grown in 2-row plots of 3.0 m long with 30 cm row spacing. Plots were seeded on 10 May at 80 seeds/m^2. The experiment was arranged in a split-plot design with cultivars as the main plots and treatments as the subplots with three replications. All plots were hand sprayed with artificially infected pea straw by *Mycosphaerella pinodes* at 10 g/m^2 at 6-10 node stage. Plots were sprayed with Bravo at 2.0 kg a. I./ha either once, twice, or three times during the growing season at 10-12 node, early, mid and late-flowering stage. Control plots were not sprayed (Table 1). The fungicide was applied in a water volume of 300 L/ha using a compressed air sprayer with 12.0 L capacity and equipped with a single nozzle. Disease severity was recorded on a scale of 0 (no disease) to 9 (all leaves of the plant severely blighted) at pod fill stage. Total seed yield per plot and 1000-seed weight adjusted to 13% seed moisture content were determined on 14 September.

RESULTS: All Bravo treatments were effective in reducing Mycosphaerella blight and increasing yield in comparison to the unsprayed checks (Table 2). The disease severity of treated plots was not affected by application time and frequency. Due to the drought in June and July, the severity of Mycosphaerella blight in control plots declined late in the season. Compared to the untreated controls, two applications at early and late flowering stages significantly increased yield on AC Tamor and so did the three applications on Radley. Other treatments did not improve yield to a significant level. Seed weight was significantly increased by the triple applications on AC Tamor and single application at mid-flowering stage on Radley. In general, seed weight was greater in multiple applications than single or no application.

CONCLUSIONS: Bravo was effective in reducing the severity of Mycosphaerella blight and increasing seed yield and quality. The effect on yield was greatest when Bravo was applied three times or twice at early and late flowering stages.

Table 1. Bravo application schedule used in 1995.

		Time			
Treatment	Frequency	10-12th node Flowering	Early Flowering	Middle Flowering	Late
0-0-0-0 (ck)	0				
B-0-0-0	1	Bravo*			
0-B-0-0	1		Bravo		
0-0-B-0	1			Bravo	
B-B-0-0	2	Bravo	Bravo		
0-B-B-0	2		Bravo	Bravo	
0-B-0-B	2		Bravo		Bravo
0-B-B-B	3		Bravo	Bravo	Bravo

* Applied at 2.0 kg a.i./ha.

Table 2. Effect of Bravo applications on control of Mycosphaerella blight of field peas.

Cultivar	Treatment	Disease severity (0-9)	Yield (kg/ha)	1000-seed weight(g)
AC Tamor	0-0-0-0 (ck)	4.7 a*	1733 b	236 b
	B-0-0-0	2.7 b	1862 ab	229 b
	0-B-0-0	2.3 b	2169 ab	230 b
	0-0-B-0	2.7 b	1893 ab	230 b
	B-B-0-0	2.7 b	1822 ab	246 ab
	0-B-B-0	2.0 b	1938 ab	231 b
	0-B-0-B	2.3 b	2569 a	261 ab
	0-B-B-B	2.3 b	2364 ab	266 a
Radley	0-0-0-0 (ck)	4.7 a	1578 b	170 b
	B-0-0-0	2.7 b	1604 b	178 ab
	0-B-0-0	2.7 b	1658 ab	170 b
	0-0-B-0	3.0 ab	1844 ab	192 a
	B-B-0-0	3.0 ab	1916 ab	181 ab
	0-B-B-0	3.3 ab	1876 ab	185 ab
	0-B-0-B	3.7 ab	2111 ab	185 ab
	0-B-B-B	2.7 b	2147 a	177 ab

* Values in the same column followed by the same letter under each cultivar are not significantly different at $P = 0.05$ (LSD).

PLANT PATHOLOGY / PHYTOPATHOLOGIE

POTATOES / POMMES DE TERRE

Section Editor / Réviseur de section : R.P. Singh

#122 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 390-1252-9201

CROP: Pepper, field, cv. Bell Boy

PEST: Gray mold, *Botrytis cinerea* Pers

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TITLE: EFFICACY OF FUNGICIDES AGAINST BOTRYTIS CINEREA ON FIELD PEPPERS

MATERIALS: MAESTRO 75% DF (captan); BENLATE 50% WP (benomyl); ROVRAL WDG (iprodione 500 g/kg)

METHODS: Three trials at three sites: Agassiz, Chilliwack and Abbotsford were conducted on field peppers for the control of gray mold. 'Bell Boy' pepper plants were transplanted into plastic mulch covered raised beds on May 9 at Chilliwack, May 15 at Agassiz, and May 26 at Abbotsford. The plants at Agassiz were covered with a plastic tunnel immediately after planting. The tunnel was removed in the second week of July. Each plot consisted of 8 plants spaced 45 cm apart. Treatment plots were 1.0 m x 1.8 m and were replicated 4 times in a randomized complete block design. The captan + benomyl treatment was applied 6 times starting at bloom stage and repeated every 7-10 d. The iprodione treatment was applied 4 times starting at bloom stage and repeated every 3 weeks. Treatments were applied in 180 ml water/plot with a backpack sprayer. Peppers were harvested from August 30 to October 11, August 30 to October 16, and August 30 to October 18 at Agassiz, Abbotsford and Chilliwack respectively and sorted into marketable number and weight, undersize number and weight, sunscald number and weight and rot number and weight. Analysis of variance was evaluated for the yield data.

RESULTS: All fungicide treatments significantly ($P = 0.05$) reduced the number and weight of rotten pepper fruit. There was no effect on number and weight of marketable or undersize fruit.

CONCLUSIONS: MAESTRO + BENLATE and ROVRAL are effective at reducing numbers of rotten fruit due to botrytis cinerea infection in field peppers.

Table 1. Mean yield per plant at Agassiz. Weight in grams.

	Rate	Marketable*		Undersize		Rot	
Treatment	ai/ha	number	weight	number	weight	number	weight
Check	---	17.6a	2663a	6.1a	363a	2.7a	204a
MAESTRO +	2.25 kg						
BENLATE	0.55 kg	18.3a	2866a	7.0a	311a	1.3b	107b
ROVRAL	0.75 kg	18.1a	2908a	5.4a	326a	1.4b	115b

Table 2. Mean yield per plant at Abbotsford. Weight in grams.

	Rate	Marketable*		Undersize		Rot	
Treatment	ai/ha	number	weight	number	weight	number	weight
Check	---	7.4a	1233a	2.4a	143a	1.8a	142a
MAESTRO +	2.25 kg						
BENLATE	0.55 kg	8.1a	1289a	3.4a	201a	0.8a	45b
ROVRAL	0.75 kg	8.1a	1311a	2.2a	140a	1.1a	46b

Table 3. Mean yield per plant at Chilliwack. Weight in grams.

	Rate	Marketable*		Undersize		Rot	
Treatment	ai/ha	number	weight	number	weight	number	weight
Check	---	11.0a	1734a	5.5a	323a	2.6a	204a
MAESTRO +	2.25 kg						
BENLATE	0.55 kg	12.0a	1734a	6.8a	418a	1.2b	78b
ROVRAL	0.75 kg	10.6a	1705a	6.3a	351a	1.1b	87b

* For all three tables means calculated from 4 replications. For each table numbers in each column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

#123 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 300 1251 9102

CROP: Potato, *Solanum tuberosum* L.

PEST: *Synchytrium endobioticum* (Schilb.) Perc.

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TITLE: ERADICATION OF *SYNCHYTRIUM ENDOBIOTICUM* BY TREATING SOIL WITH CRUSHED CRABSHELL

MATERIALS: Meat-free (shucked) crabs legs; potatoes cv. Arran Victory; *S. endobioticum*-infested field soil; field site.

METHODS: Ten 1-m² plots were dressed with finely crushed shucked crabs legs. These plots were contiguously placed across the field. The plots were amended at rates of 0, 1 and 3% crabshell. The shell was blended into the top 5 cm soil. Subsamples were taken at start and after 2 mo in year 1 and at 2 mo intervals in year 2.

RESULTS: The spore counts fell by 3% at 0% crabshell, but by 11.6 and 12.4% at 1 and 3% crabshell in year 1. Tests for significance indicated none at 0% and significant for the two treatments at $P = 0.25$. Current readings are still in progress.

CONCLUSIONS: This is a promising result.

#124 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Potato, cv. Green Mountain

PEST: *Alternaria solani* (ELL. & Martin) Sor.
Phytophthora infestans (Mont.) deBary
Solanum tuberosum (L.)

NAME AND AGENCY:
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TITLE: FUNGICIDE EFFICACIES FOR CHEMICAL CONTROL OF EARLY AND LATE BLIGHT OF POTATOES, 1994

MATERIALS: Treatments of chlorothalonil (Bravo 500; 40%e.c.; ISK-Biotech) were applied at 1.0 L a.i. ha^{-1} every 7 d, chlorothalonil (Bravo Ultrex 825; 82.5% g; ISK-Biotech) applied at 0.8 and 1.2 kg a.i. ha^{-1} every 7 d, chlorothalonil + zinc sulphate (Bravo Zn; 40%e.c.; ISK-Biotech) applied at 0.7 L a.i. ha^{-1} every 7 d, copper oxychloride (Kocide; 50%w.p.; United Agro Products) applied at 1.4 kg a.i. ha^{-1} every 7 d, copper sulfate (Clean Crop; 50% w.p.; United Agro Products) applied at 2.7 kg a.i. ha^{-1} at row closure (mid-July) with chlorothalonil (Bravo 500; 40% e.c.; ISK-Biotech) applied at 1.0 L a.i. ha^{-1} every 7 d thereafter, ASC-66825 (Fluazinam; 40% e.c. and 75% d.g.; ISK-Biotech) applied at 0.2 L and 0.2 kg a.i. ha^{-1}, respectively, every 7 d, ASC-66825A-C (Fluazinam A, Fluazinam B and Fluazinam C; 40% e.c.; ISK-Biotech) applied at 0.5 L a.i. ha^{-1} in-furrow at planting, in-furrow at planting plus after final hilling and on three occasions starting at early bloom (early to mid-July) with 14 d spray intervals, respectively, ASC-67098Z (Fluazinam Z; 84% d.g.; ISK-Biotech) applied at 1.2 kg a.i. ha^{-1} every 7 d, ASC-67178 (Fluazinam X and Fluazinam Y; 81% w.p.; ISK-Biotech) applied at 1.6 kg a.i. ha^{-1} at early bloom and at early bloom plus 14 d later with chlorothalonil (Bravo Ultrex 825; 82.5% g; ISK-Biotech) applied at 1.2 kg a.i. ha^{-1} on all other weekly spray dates for both treatments, ASC-67178G (Fluazinam G; 60% w.p., ISK-Biotech) applied at 1.2 kg a.i. ha^{-1} at early bloom and then 14 d later with chlorothalonil (Bravo Ultrex 825; 82.5% g; ISK-Biotech) applied at 1.2 kg a.i. ha^{-1} on all other weekly spray dates for both treatments, mancozeb (Dithane; 75% d.g.; Rohm & Haas) applied at 1.0 kg a.i. ha^{-1} every 7 d and at 1.7 kg a.i. ha^{-1} every 7 d and based on a disease prevention forecast system (= Dithane T; 10-14 d spray schedule), mancozeb (Penncozeb DF; 75% d.g.; ATOCHEM) applied at 1.7 kg a.i. ha^{-1} every 7 d and experimental materials (RH7281F; 24% e.c.; ROHM & HAAS) applied at 0.3 L a.i. ha^{-1} every 7 d and (RH7281FD; 24% e.c.; ROHM & HAAS) applied at 0.1 and 0.2 L a.i. ha^{-1} with mancozeb (Dithane; 75% d.g.; ROHM & HAAS) applied at 1.0 kg a.i. ha^{-1} every 7 d, experimental materials (RH7281W; 50% w.p., ROHM & HAAS) applied at 0.3 kg a.i. ha^{-1} every 7 d and (RH7281WD; 50% w.p., ROHM & HAAS) applied at 0.1, 0.2 and 0.3 kg a.i. ha^{-1} with mancozeb (Dithane; 75% d.g.; Rohm & Haas) applied at 1.0 kg a.i. ha^{-1} every 7 d, experimental materials (ZN0001 and ZN0002; 75% g.; ICI-ZENECA) applied at 3.0 and 2.3 kg a.i. ha^{-1}, respectively, every 7 d and experimental material (ZNICIA-5504; 80% w.p.; ICI-ZENECA) applied at 2.0 kg a.i. ha^{-1} every 7 d.

METHODS: For each treatment, four replicate plots consisting of five rows (7.5 m in length, spaced 0.9 m apart) were established in a randomized complete block design in 1994. All five-row plots were separated by two buffer rows for tractor operations. Whole (35-55 mm), green sprouted, Elite 3 seed tubers (cv Green Mountain) were hand-planted 30 cm apart and recommended crop management practices were followed. Plant emergence counts on the centre row of each five-row plot were made 40-50 d post-planting. A sporangial suspension was applied to the foliage of plants in the two outer rows of each five-row plot 2-3 d after the first fungicide application and 2-3 weeks later as required. The sporangial suspension was comprised of 5000 sporangia ml^{-1} of *Phytophthora infestans* (races 1-4) cultured on leaves of Green Mountain. Plots were mist irrigated (3-5 mm h^{-1} for 2-4 h periods) during July and August to maintain the disease in the inoculated rows. Late blight damage (amount of diseased foliage as a percentage of total plant foliage) in plants in the centre row of each five-row plot were made throughout August and September. Natural occurring inoculum of *Alternaria solani* were relied upon for establishment of early blight. Early blight incidence (amount of diseased foliage as a percentage of total plant foliage) and severity (0 = no symptoms, 1 = slight leaf spotting, 2 = moderate and 3 = severe with 25% or more of the foliage having many lesions) in plants in the centre row of each five-row plot were made throughout August and September. Fungicide applications (tractor-mounted sprayer modified to spray only the centre three rows with three hollow-cone nozzles/row, 450 L/Ha volume, 860 kPa) were first made a few days before inoculation and/or according to the treatment application schedule. Top desiccant was applied mid-late September, two weeks prior to plot harvest when tuber yields and late blight tuber rot occurrence (% by weight) were determined. All data were subjected to analysis of variance (arcsin transformation of percentage data was done prior to analysis).

RESULTS: All plots had 100 % emergence and early blight damage increased during the course of the season. No significant differences in early blight severity were obtained (data not included) but by 12 September Fluazinam applied at 0.2 litres a.i. ha^{-1} had significantly less early blight (%) than several other fungicide treatments (Table 1). Late blight foliar damage and late blight tuber rot did not occur probably due to the record dry period from early July to the end of August. Total tuber yields (Table 1) and yields of graded (<55mm and >55mm) tubers were not affected by foliar fungicide treatment.

CONCLUSIONS: July and August had record breaking warm, dry weather conditions. This prevented the development of a late blight epidemic and appeared to delay early blight spread. Other than the reduced incidence in early blight with one of the Fluazinam treatments, no significant differences were found among the fungicide treatments in terms of efficacy of foliar disease control and yields. Further studies will be conducted to confirm fungicide efficacies before recommendations on their use will be made.

Table 1. Effect of fungicides on early blight and yield of potatoes in 1994.

Treatment	Rate ai ha^{-1}	Early Blight (%)	Yield (T/Ha)	Treatment	Rate ai ha^{-1}	Early Blight (%)	Yield (T/Ha)
Untreated		47	34.0	Kocide	1.4 kg	31	36.0
Fluazinam	0.2L	19	38.7	Dithane	1.0 kg	31	36.1
Fluazinam	0.2Kg	21	39.3	Dithane	1.7 kg	39	37.7
Fluazinam A	0.5L	42	35.0	Dithane T	1.7 kg	46	36.8
Fluazinam B	0.5L	41	36.4	Penncozeb	1.7 kg	39	34.7
Fluazinam C	0.5L	39	38.0	RH7281FD	0.1 L	31	37.4
Fluazinam G	1.2Kg	33	37.4	RH7281FD	0.2 L	43	36.4
Fluazinam X	1.6Kg	29	40.1	RH7281F	0.3 L	48	32.7
Fluazinam Y	1.6Kg	33	34.0	RH7281WD	0.1 kg	33	35.7
Fluazinam Z	1.2L	26	35.3	RH7281WD	0.2 kg	38	37.5
Bravo500	1.0L	34	38.2	RH7281WD	0.3 kg	36	33.4
Bravo Ultrex	1.2Kg	34	36.4	RH7281W	0.3 kg	35	39.6
Bravo Ultrex	0.8Kg	30	35.5	ZN0001	3.0 kg	37	36.2
Bravo ZN	0.7L	33	38.4	ZN0002	2.3 kg	35	36.6
Clean Crop	2.7Kg	32	37.4	ZNICIA-5504	2.0 kg	34	37.7
LSD ($\underline{P}$=0.05)		15.9	NS	LSD ($\underline{P}$=0.05)		15.9	NS

NS = not significantly different.

#125 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 362-1241-8501

CROP: Potato, cv. Russet Burbank

PEST: *Alternaria solani* Sor.

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TITLE: EFFICACY OF FUNGICIDES AGAINST EARLY BLIGHT ON POTATO, 1994

MATERIALS: BRAVO 500 40% F, @ 2 L/ha (Chlorothalonil)
BRAVO ZN 38.5% F @ 2 L/ha + Zn (Chlorothalonil + Zinc)
ICIA-5504 80% WG @ 125 or 250 g/ha
MAESTRO 75% DF @ 1 or 2 kg/ha (Captan)

METHODS: The trial was conducted at the AAFC, Research Centre, Morden in 1994. The trial was planted on a sandy loam soil. Spring soil nutrient levels were high (345 kg N, 65 kg P_2O_5, 444 kg K_2O and 96 kg S /ha). Granular fertilizer (19 kg N, 25 kg P_2O_5 and 28 kg K_2O/ha) was broadcast and incorporated pre-plant. Seed tubers were hand cut to produce seed pieces between 40 and 80 g in weight. Four replicates were planted in an RCBD experimental design. Individual plots consisted of 4 rows, 10 m in length, with 1 m between row centres. The trial was planted on May 10, using a plot planter, with seed pieces spaced every 38 cm. Applications of sethoxydim and metribuzin were made to control weeds, and deltamethrin and endosulfan were applied to control Colorado potato beetle. Row-cultivation/ hilling was carried out in late June. Fungicide applications were made using a small plot, tractor-mounted, compressed air sprayer, equipped with flat fan nozzles, which applied about 150L of spray volume/ha at 275 kPa pressure. Fungicide treatments were applied on about a 10 d schedule, with the first and last applications on June 23 and September 6. Plots were rated weekly for percentage of foliage affected by natural infection with early blight. Five plants were visually rated for percent of foliage affected, with the five values averaged for each plot rating. The centre two rows of each plot were harvested on September 22 and the harvested yield placed into storage until grading in mid-October. Grading was carried out simulating procedures used by a local french fry processor. Tuber yield, tuber size distribution, incidence of hollow heart and fry colour from a 10•C storage were used to determine gross return to the grower for each treatment.

RESULTS: All data was subject to analysis of variance, followed by mean separation test (least significant difference) only if probability values from the analysis of variance were • 0.05. Early blight occurred early and spread rapidly in 1994. As early as July 21, Bravo 500, Bravo Zn and the ICIA-5504 treatments showed significantly lower foliage infection with early blight. The ICIA-5504 treatments consistently showed the best control of early blight. Bravo Zn and Bravo 500 provided good early blight control, with Bravo Zn showing slightly better, although not always significantly better, control than Bravo 500. Maestro 75DG at the 1 and 2kg/ha rates, showed a small improvement in early blight control, relative to the Check. The tuber yield and gross return to the grower of the fungicide treatments, correlated well with the effectiveness of the fungicides to control early blight. Differences between treatments for specific gravity and french fry colour from storage were not significant. Higher incidences of hollow heart were observed for the Maestro 75DG (1kg/ha) and ICIA-5504 (125g/ha) treatments. However, these did not appear to be related to the active ingredient or the rate of product used, as the higher rate of each of these products showed lower incidences of the physiological disorder. Using the guidelines in the processor contract, incidences of hollow heart greater than 3% of total yield by weight, would affect the return to the grower.

CONCLUSIONS: In this study, fungicide treatments could be ranked on their efficacy for control of early blight, and resulting effects on tuber yield and return to grower, as follows: ICIA-5504 (250 g/ha) • ICIA-5504 (125 g/ha) >Bravo Zn• Bravo 500 >Maestro 75DG (2 kg/ha), Maestro 75DG (1 kg/ha), Check. ICIA-5504 provided good control of early blight in 1994, substantially improving tuber yield and gross return to the producer. The higher application rate, 250 g/ha, showed slightly better disease control and higher tuber yields and gross return to the grower. The response of Bravo Zn and Bravo 500 were intermediate to the ICIA-5504 treatments, and the Check and Maestro 75DG treatments. Bravo Zn tended to show better disease control than Bravo 500, although the difference were only occasionally significant. Maestro 75DG at the 1 or 2 kg/ha rate provided only slightly better, generally non-significant, control of early blight than the Check.

Table 1. Effects of fungicide treatment on foliar early blight ratings (selected dates) and Area Under Disease Progress Curve (AUDPC - all dates).

	Foliar Early Blight Rating (% of foliage)				
Treatment (Rate)	Jul-21	Aug-10	Sep-02	Sep-16	AUDPC
CHECK (water)	1.8 a	10.8 a	100.0 a	100.0 a	408.2 a
BRAVO 500 (2 L/ha)	1.2 b	6.1 bc	86.8 b	100.0 a	301.3 c
BRAVO Zn (2 L/ha)	1.1 b	3.8 cd	68.8 c	99.0 a	253.2 d
ICIA-5504 (125 g/ha)	0.3 c	1.3 d	55.8 d	95.5 a	215.6 e
ICIA-5504 (250 g/ha)	0.4 c	1.4 d	38.7 e	86.8 b	175.5 f
MAESTRO 75%DF (1k g/ha)	1.2 a	8.5 ab	96.7 ab	100.0 a	366.5 b
MAESTRO 75%DF (2k g/ha)	1.1 a	6.2 bc	97.8 ab	99.8 a	352.2 b
sig. (P=)	0.0001	0.0001	0.0001	0.0003	0.0001
LSD (5%)	0.44	2.78	12.86	5.26	28.88
CV (%)	30.4	34.6	11.1	3.6	6.5

Table 2. Effects of fungicide treatment on marketable (>1f ")and bonus (>284 g) tuber yield, specific gravity, fry colour and gross return to grower.

	Tuber Yield (T/ha)		Specific	Hollow	Fry	Gross
Treatment (Rate)	Marketable	Bonus	Gravity	Heart[1]	Colour[2]	Return[3]
CHECK (water)	24.2 c	4.9 c	1.093	2.2 b	5.5	2,932 c
BRAVO 500 (2 L/ha)	32.5 b	10.0 b	1.093	2.1 b	4.2	4,071 b
BRAVO Zn (2 L/ha)	33.2 ab	12.2 ab	1.090	3.0 b	5.1	4,206 b
ICIA-5504 (125 g/ha)	35.0 ab	12.8 a	1.094	4.1 ab	4.2	4,411 ab
ICIA-5504 (250 g/ha)	37.7 a	14.7 a	1.094	2.3 b	5.1	4,833 a
MAESTRO 75 DF (1 kg/ha)	24.7 c	5.5 c	1.094	6.5 a	4.9	2,920 c
MAESTRO 75 DF (2 kg/ha)	26.9 c	6.1 c	1.093	1.6 b	4.8	3,205 c
sig. (P=)	0.0001	0.0001	0.1921	0.0151	0.0877	0.0001
LSD (5%)	4.73	2.62	n.s.[4]	2.66	n.s.	605.4
CV (%)	10.4	18.6	0.2	57.3	13.4	10.7

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[1] Hollow Heart - percent of total yield by weight.

[2] Fry Colour - (7 = USDA 000 - light to 1 = USDA 4 - dark).

[3] Gross Return - return to grower based on local processor contract ($/ha).

[4] n.s. - non-significant

#126 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 362-1241-8501

CROP: Potato, cv. Russet Burbank

PEST: *Alternaria solani* Sor.

NAME AND AGENCY:

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TITLE: EFFICACY OF FUNGICIDES AGAINST EARLY BLIGHT ON POTATO, 1995

MATERIALS: Fungicide treatments included the following (all treatments applied on about a 7 d schedule):

1. CHECK (water);
2. POLYRAM 7% D @ 28.6 kg/ha (metiram);
3. ICIA-5504 @ 125 g/ha;
4. ICIA-5504 @ 250 g/ha;
5. MAESTRO 75% DF @ 2 kg/ha (captan);
6. ICIA-5504 @ 125 g/ha + MAESTRO 75% DF @ 1 kg/ha;
7. BRAVO 500 40% F @ 1.73 L/ha (chlorothalonil) all dates except July 11, BRAVO 500 40% F @ 2 L/ha + RIDOMIL 240EC @ 0.8 L/ha (chlorothalonil + metalaxyl) on July 11;
8. DITHANE 75% DG @ 2.23 kg/ha (mancozeb) all dates except July 11, RIDOMIL MZ 72% WP @ 2.47 kg/ha (mancozeb + metalaxyl) on July 11;
9. BRAVO ZN 38.5% F @ 2.34 L/ha (chlorothalonil + zinc);
10. BRAVO 500 40% F @ 1.73 L/ha (chlorothalonil) all dates except September 5 and 11, DACOBRE 27 DG @ 4.48 kg/ha on September 5 and 11;
11. BRAVO ULTREX 82.5% DG @ 1.34 kg/ha (chlorothalonil);
12. DITHANE 75% DF @ 2.22 kg/ha (mancozeb);
13. BRAVO 500 40% F @ 1.73 L/ha (chlorothalonil)
14. BRAVO 500 40% F @ 1.73 L/ha (chlorothalonil) all dates except July 11 and 25, RIDOMIL MZ 72% WP @ 2.47 kg/ha (mancozeb + metalaxyl) July 11 & 25.

METHODS: The trial was conducted at the AAFC, Research Centre, Morden in 1995. The trial was planted on a sandy loam soil. Spring soil sampling revealed the following nutrient levels 72 kg N, 94 kg P_2O_5, 758 kg K_2O and 49 kg S/ha). Solution fertilizer (129 kg N, 59 kg P_2O_5 and 157 kg K_2O/ha) was broadcast and incorporated pre-plant. Seed tubers were hand cut to produce seed pieces between 40 and 80 g in weight. Four replicates were planted in a RCBD design. Individual plots consisted of 4 rows, 10 m in length, with 1 m between row centres. A 3 m space was left between adjacent plots for the tractor mounted sprayer to travel on. The trial was planted on May 16, using a plot planter, with seed pieces spaced every 38 cm. Row-cultivation/hilling was carried out in late June. Applications of sethoxydim and metribuzin were made to control weeds, and deltamethrin and endosulfan were applied to control Colorado potato beetle. Fungicide applications were made using a small plot, tractor-mounted, compressed air sprayer, equipped with flat fan nozzles, which applied about 150L of spray volume/ha at 275 kPa pressure. All fungicide treatments were applied on about a 7 d schedule, between July 4 and September 11. Plots were rated every 6 to 10 d for percentage of foliage affected by natural infection with early blight. Five plants were visually rated for percent of leaf area affected, with the five values averaged for each plot rating. The centre two rows of each plot was harvested on September 29 and the harvested yield placed into storage until grading in mid-October. Grading was carried out simulating procedures used by a local french fry processor. Tuber yield, tuber size distribution and incidence of hollow heart were used to determine gross return to the grower for each treatment.

RESULTS: All data was subject to analysis of variance, followed by mean separation test (least significant difference) only if probability values from the analysis of variance were• 0.05. Early blight symptoms developed slower than in 1994. On July 28, differences between treatments were observed, with all treatments, except 2, 7, and 12, showing lower levels of foliar early blight infection than the CHECK (Table 1). A lower AUDPC was calculated for all treatments, compared with the CHECK. The lowest levels of foliar infection and AUDPC occurred with treatments 3, 4, 6 and 9. The first three included the product ICIA-5504, either alone, or as tank mix. The fourth is BRAVO ZN. Treatment 2 (POLYRAM 7D), 5 (MAESTRO), performed poorer than treatment 14, a recommended spray program for control of early and late blight in potatoes. In 1995, tuber yield and gross return to the grower of the fungicide treatments, appeared to correspond with the effectiveness of treatments to control early blight. However, yield differences were not as dramatic as observed in 1994. Differences between treatments for specific gravity were non-significant. Higher incidences of hollow heart were observed for treatments 6 and 9. However, these did not appear to be related to the active ingredient of the product, as other treatments with the same products, did not show high levels of the physiological disorder. Only tuber samples from two plots had levels of hollow heart greater than 3% of total yield by weight, which would affect the return to the grower based on the guidelines in the processor contract.

CONCLUSIONS: ICIA-5504 provided good control of early blight in 1994, substantially improving tuber yield and gross return to the producer. The higher application rate, 250g/ha, showed slightly better disease control and higher tuber yields and gross return to the grower. The responses of Bravo Zn and Bravo 500 were intermediate to the ICIA-5504 treatments, and the Check and Maestro 75DG treatments. Bravo Zn tended to show better disease control than Bravo 500, although the differences were only occasionally significant. Maestro 75DG at the 1 or 2kg/ha rate provided only slightly better, generally non-significant, control of early blight than the Check.

Table 1. Effects of fungicide treatment on foliar early blight ratings (selected dates) and Area Under Disease Progress Curve (AUDPC - all dates).

	Foliar Early Blight Rating (% of foliage)			
Treatment	Jul-28	Aug-21	Sep-15	AUDPC
1	2.3 a	9.8 ab	89.8 ab	145.9 a
2	2.0 abc	7.6 cd	81.0 bc	108.2 bc
3	1.3 d	3.4 I	38.5 h	45.7 f
4	1.3 d	3.9 hi	44.0 h	50.4 f
5	1.8 bc	7.9 c	81.0 bc	119.9 b
6	1.3 d	3.3 I	40.5 h	46.4 f
7	1.9 abc	5.9 efg	63.3 efg	91.2 cd
8	1.8 bc	5.5 efgh	73.5 cde	92.8 cd
9	1.6 cd	4.3 ghi	56.7 g	66.6 ef
10	1.9 bc	4.6 fghi	59.5 fg	80.9 de
11	1.8 bc	3.9 hi	60.8 fg	73.4 de
12	2.0 abc	7.1 cde	75.3 cd	94.3 cd
13	1.9 bc	6.2 def	69.0 def	91.3 cd
14	1.8 bc	4.9 fghi	61.8 efg	82.7 de
sig. (P=)	0.0005	0.0001	0.0001	0.0001
LSD (5%)	0.45	1.61	11.77	22.85
CV (%)	17.6	18.8	12.3	17.5

Table 2. Effects of fungicide treatment on marketable (>48mm)and bonus (>284g) tuber yield, specific gravity, fry colour and gross return to grower.

Treatment	Tuber Yield (T/ha) Marketable	Bonus	Specific Gravity	Hollow Heart[1]	Gross Return[2]
1	30.4 def	9.8	1.083	0.11 c	3,920 de
2	32.9 bcdef	10.9	1.083	0.28 c	4,276 bcde
3	33.4 abcdef	11.4	1.083	0.22 c	4,342 abcd
4	37.3 a	13.7	1.092	1.00 abc	4,868 a
5	29.5 f	8.7	1.085	0.29 c	3,779 e
6	35.6 ab	11.4	1.089	2.11 a	4,567 ab
7	34.3 abcd	9.8	1.088	0.45 bc	4,394 abcd
8	33.2 bcdef	8.6	1.087	0.19 c	4,216 bcde
9	34.8 abc	11.0	1.091	1.60 ab	4,470 abc
10	34.0 abcde	10.4	1.082	0.57 bc	4,384 abcd
11	32.6 bcdef	11.4	1.081	0.41 c	4,253 bcde
12	33.1 bcdef	10.1	1.088	0.25 c	4,246 bcde
13	31.0 cdef	8.2	1.088	0.40 c	3,952 cde
14	32.3 bcdef	10.3	1.082	0.33 c	4,167 bcde
sig. (P =)	0.0244	0.1632	0.1280	0.0428	0.0193
LSD (5%)	4.06	n.s.[3]	n.s.	1.167	557.2
CV (%)	8.5	29.8	0.6	137.8	9.1

[1] Hollow Heart - percent of total yield by weight.

[2] Gross Return - return to grower based on local processor contract ($/ha).

[3] n.s. - non-significant

#127 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Potato, cv. Shepody

PEST: Late blight, *Phytophthora infestans* (Mont.) de Bary

NAME AND AGENCY:
HOFF I, NG K K and ORMROD D J
British Columbia Ministry of Agriculture, Fisheries and Food
1767 Angus Campbell Road, Abbotsford, BC V3G 2M3

TITLE: EFFICACY OF FUNGICIDES AGAINST LATE BLIGHT OF POTATO, 1995

MATERIALS:

1. TATTOO (20% propamocarb + 24% mancozeb) @ 4 L/ha every 7 days.

2. TATTOO (20% propamocarb + 24% mancozeb) @ 4 L/ha every 10 days.
3. TATTOO (20% propamocarb + 24% mancozeb) @ 4 L/ha every 14 days.
4. TATTOO (20% propamocarb + 24% mancozeb) @ 5 L/ha every 14 days.
5. ICIA-5504 80WG (methyl (E) -2-(2-(6-(2-cyanophenoxy) pyrimidin -4-yloxy)-3-methoxyacrylate) @ 0.125 kg a.i./ha every 10 days.
6. ICIA-5504 80WG @ 0.250 kg a.i./ha every 10 days.
7. MAESTRO 75WG (captan) @ 2.00 kg a.i./ha every 10 days.
8. ICIA-55OW 80WG @ 0.125 kg a.i./ha + MAESTRO 75WG @ 1.00 kg a.i./ha every 10 days.
9. DITHANE DG (mancozeb) @ 2.0 kg/ha + BOND sticker every 10 days.
10. DITHANE DG @ 2.0 kg/ha every 10 days.
11. PENNCOZEB 80W (mancozeb) @ 1.12 kg/ha until row closure and 2.24 kg/ha thereafter every 10 days.
12. PENNCOZEB 75DF (mancozeb) @ 1.12 kg/ha until row closure and 2.24 kg/ha thereafter every 10 days.
13. TD 2343-02 3.5Fl (mancozeb) @ 2.81 L/ha until row closure and 5.62 L/ha thereafter every 10 days.
14. TD 2343-02 3.5Fl @ 2.1 L/ha until row closure and 4.2 L/ha thereafter every 10 days.
15. MANEB 80W @ 1.12 kg/ha until row closure and 2.24 kg/ha thereafter every 10 days.
16. KOCIDE 101 (copper hydroxide, 50% metallic copper equivalent) @ 1.12 kg/ha until row closure and 2.25 kg/ha thereafter + DITHANE DG @ 1.75 kg/ha until row closure and 2.25 kg/ha thereafter every 10 days. Followed by KOCIDE 101 @ 3.4 kg/ha after topkill.
17. KOCIDE 101 @ 1.12 kg/ha until row closure and 2.25 kg/ha thereafter plus BRAVO 500 (chlorothalonil) @ 1.2 L/ha until row closure and 2.4 L/ha thereafter every 10 days followed by KOCIDE 101 @ 3.4 kg/ha after top kill.
18. SUPER TIN 80W (triphenyltin hydroxide) @ 0.175 kg/ha + DITHANE DG @ 1.75 kg/ha every 10 days.
19. ACROBAT 50WP (dimethomorph) @ 0.225 kg a.i./ha every 10 days.
20. ACROBAT 50WP @ 0.225 kg a.i./ha + MANZATE 200 (mancozeb) @ 1.5 kg a.i./ha every 10 days.
21. BRAVO 500F (chlorothalonil) @ 1.25 L/ha until row closure and 2.5 L/ha thereafter every 10 days.
22. IB 11925 (cholorothalonil) @ 2.0 L/ha every 10 days.
23. BRAVO ULTREX (chlorothalonil) @ 0.78 kg/ha until row closure and 1.56 kg/ha thereafter every 10 days.
24. BRAVO ZINC @ 1.25 L/ha until row closure and 2.5 L/ha thereafter every 10 days.
25. BRAVO 500 F @ 1.25 L/ha alternated with RIDOMIL/BRAVO 81W (9% metalaxyl + 72% chlorothalonil) @ 2.229 kg/ha every 10 days.
26. MANZATE 200 @ 2.229 kg/ha alternated with RIDOMIL MZ-72 (8% metalaxyl + 64% mancozeb) @ 2.787 kg/ha every 10 days.
27. IB 11522 (chlorothalonil + fluazinam) @ 0.976 L/ha until row closure and 1.753 L/ha thereafter very 10 days.
28. CURZATE M8 (8% cymoxanil + 64% mancozeb) @ 1.0 kg/ha every 10 days.
29. MANEX C-8 (8% cymoxanil + 64% mancozeb) @ 1.4 kg/ha every 10 days.

30., 31. and 32. UNTREATED

METHODS: Cut seed of Elite III Shepody potatoes was planted using a two-row planter on May 9, 1995 in a clay loam soil at Langley, B.C. which had grown potatoes in both 1993 and 1994. Experimental plots were 6m long x 2 rows wide with 1 m of bare ground between plots on all sides and with 4 replications arranged in a randomized complete block design. Fungicides were applied according to manufacturers directions in a volume of 400 L/ha using a hand sprayer beginning on June 21 and ending on August 22. Diazinon 500EC was applied twice during the season for control of tuber flea beetle.

Blight assessment was done on August 17, 24 and 31 using a 0-5 rating system with 0 being no blight and 5 being more than 50% of total leaf area blighted. Twenty separate ratings were made for each replicate of each treatment at each date and the results were subject to analysis of variance and Student - Newman - Keuls' test. The crop was top-killed with Reglone on September 6 and harvested on September 21 and 22. Yield of marketable and unmarketable tubers and number of infected tubers was recorded. The marketable tubers were bagged in burlap sacks and placed in storage for observation on rot development.

RESULTS: Results are shown in Table I. For consistency, all blight severity ratings were done by K.N. At harvest, however, several different workers were involved in sorting marketable, non-marketable and rotted tubers. The results of the grading were highly variable, therefore only the differences in total yield are of significance.

CONCLUSIONS: Although blight did not appear until the first week of August, it spread throughout all the treatments so that virtually all plants had at least a few infections by the end of the month. None of the fungicides were able to prevent infection completely but they provided an increase in total yield of close to 50%.

Table 1. Effect of fungicides on late blight severity and tuber yield in Shepody potatoes.

Treatment	Average Blight Severity			Average Number of Infected Tubers Plot	Average Total Yield (T/ha)
	August 17	August 24	August 31		
1	0b*	1.04ef	1.04f	4.2a	45.54a
2	0.06b	2.10cde	2.42def	5.0a	44.43a
3	0.02b	1.45cdef	2.24def	6.5a	48.16a
4	0.01b	1.20def	1.54ef	8.5a	45.18
5	0.05b	2.31cbd	3.59bc	4.8a	45.52a
6	0.05b	2.52bc	3.56bc	1.8a	45.52a
7	0.02b	2.39bcd	3.69bc	4.5a	44.11a
8	0.12b	2.36bcd	3.20cd	4.0a	44.32a
9	0b	0.95ef	1.50ef	10.0a	47.90a
10	0b	1.30cdef	1.49ef	5.5a	43.19a
11	0.01b	1.38cdef	2.14def	9.0a	45.66a
12	0.02b	1.64cdef	2.08def	11.5a	40.97a
13	0b	1.38cdef	1.61ef	6.0a	45.07a
14	0.25b	1.66cdef	2.09def	9.2a	46.48
15	0.04b	1.54cdef	1.84def	6.2a	44.55a
16	0.04b	1.45cdef	2.00def	7.0a	43.61a
17	0b	1.26def	1.82def	4.0a	42.25a
18	0b	1.05ef	1.46ef	6.2a	45.52
19	0.09b	3.11b	4.45ab	2.0a	40.96a
20	0b	1.21def	1.86def	4.2a	45.51a
21	0.01b	1.51cdef	1.91def	10.2a	43.10a
22	0.06b	0.76f	1.49ef	6.2a	47.29a
23	0b	1.29def	1.82def	6.8a	46.91a
24	0.02b	1.80cdef	2.15def	5.8a	44.41a
25	0.02b	1.88cdef	2.36def	10.0a	47.55a
26	0.02b	1.34cdef	1.82def	5.0a	46.19a
27	0b	1.74cdef	1.99def	11.8a	40.96a
28	0.02b	2.06cde	2.84cde	13.0a	42.28a
29	0.14b	1.84cdef	2.78cde	10.5a	44.57a
30	2.48a	4.64a	4.99a	9.5a	28.80b
31	1.91a	4.51a	5.00a	6.8a	31.73b
32	2.50a	4.95a	5.00a	8.2a	32.55b

* Means followed by the same letter(s) in each column do not differ significantly ($P<0.05$) as verified by Student-Newman-Keul's test.

#128 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 362-1241-8501

CROP: Potato, cvs. Russet Burbank and Shepody

PEST: *Rhizoctonia solani* Kühn, *Fusarium spp.*

NAME AND AGENCY:
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TITLE: EFFICACY OF TRITICONAZOLE AND IPRODIONE AGAINST SEED PIECE DECAY AND RHIZOCTONIA ON POTATO, 1994

MATERIALS: Seed piece treatments included the following:
CHECK, untreated; CONTROL, Tuberseal Potato Seed Piece Dust (16% mancozeb) @ 0.5 kg/100 kg seed; EXP-80576A, Triticonazole (0.33%) @ 0.75 kg/100 kg seed; EXP-80577A, Triticonazole (0.67%) @ 0.75 kg/100 kg seed; EXP-80578A, Triticonazole (1.00%) @ 0.75 kg/100 kg seed; EXP-80590A, Iprodione (0.67%) @ 0.75 kg/100 kg seed; EXP-80591A, Triticonazole (0.67%) + Iprodione (0.67%) @ 0.75 kg/100 kg seed

METHODS: The trial was conducted at the AAFC, Research Centre, Morden in 1994. The trial was planted on a sandy loam soil. Spring soil nutrient levels were high (345 kg N, 65 kg P_2O_5, 444 kg K_2O and 96 kg S/ha). Granular fertilizer (19 kg N, 25 kg P_2O_5 and 28 kg K_2O/ha) was broadcast and incorporated pre-plant. Seed tubers were hand-cut to produce seed pieces from 40 to 80 g in weight. Cut seed pieces were put into a large plastic bag and weighed. An appropriate amount of seed piece treatment was added, and the bag was shaken until the cut seed was uniformly covered with the seed piece treatment. Four replicates were planted in an RCBD experimental design with two factors, seed piece treatment and cultivar. Individual plots consisted of 4 rows, 10 m in length, with 1 m between row centres. The trial was planted on May 13, using a plot planter, with seed pieces spaced every 38 cm. Row-cultivation/hilling was carried out in late June. Applications of sethoxydim and metribuzin were made to control weeds, deltamethrin and endosulfan were applied to control Colorado potato beetle. Regular applications of chlorothathalonil or mancozeb/metalaxyl were made to control early and late blight. Plant emergence in each plot was counted three times per week beginning when plant emergence was first observed. Emergence counts were continued until all plots had greater than 50% of seed pieces emerged. A final plant stand count was taken on June 22. Three m of row from an outside row of each plot was dug on June 16 and June 30. On each date, seed pieces were rated for: emergence (yes or no); seed piece decay (1 = no decay to 5 = completely decayed), and rhizoctonia canker (1 = no necrosis to 5 = sprouts completely girdled), resulting from natural infection; and number of main stems (stems originating directly from the seed piece) emerged. The total number of main stems in the centre two rows of each plot was counted just before harvest. The centre two rows of each plot were harvested on September 27 and the entire harvested yield placed into a forced air storage until grading in mid-October. Grading was carried out simulating procedures used by a local french fry processor. Tuber yield, tuber size distribution, incidence of hollow heart and fry colour were used in calculating a gross return to the grower for each treatment. A sample of 25 tubers was rated for: percentage of tubers with tuber deformities (secondary growth or growth cracks) and greening; percent of tuber area covered by black scurf or silver scurf; and percentage of tubers with internal necrosis (excluding hollow heart or brown centre).

RESULTS: All data was subject to analysis of variance, followed by mean separation test (least significant difference) only if probability values from the analysis of variance were • 0.05. Treatment and the Cultivar X Treatment interactions (C X T) were significant for plant emergence and plant density (Table 1). Treatments that included triticonazole delayed plant emergence in Russet Burbank, but did not affect plant emergence in Shepody. Triticonazole treatments reduced plant density in Russet Burbank, while tending to increase plant density in Shepody, compared with the CHECK and CONTROL.

Table 1. Effects of seed piece treatment and cultivar on days to 50% plant emergence, plant density, seed piece decay, and rhizoctonia stem canker

	Days to 50%	Plant	Seed Piece Decay[3]		Rhizoctonia Canker[4]	
Treatment	Emergence[1]	Density[2]	June 16	June 30	June 16	June 30
CHECK	25.4 cd	26.1 ab	1.15 b	1.22 b	1.98 a	2.60 a
CONTROL	24.0 d	24.9 bc	1.70 a	2.08 a	1.39 b	1.48 b
EXP-80576A	26.8 bc	25.4 bc	1.19 b	1.06 b	1.27 b	1.42 b
EXP-80577A	29.5 a	25.1 bc	1.18 b	1.44 b	1.23 b	1.41 b
EXP-80578A	28.9 ab	24.3 c	1.20 b	1.40 b	1.13 b	1.38 b
EXP-80590A	23.1 d	26.7 a	1.16 b	1.31 b	1.39 b	1.21 b
EXP-80591A	29.1 ab	25.1 bc	1.06 b	1.14 b	1.43 b	1.33 b
sig (Pr=)	0.0002	0.0226	0.0326	0.0109	0.0073	0.0001
lsd (5%)	2.65	1.30	0.360	0.503	0.394	0.485
CULTIVAR						
BURBANK	26.8	25.3	1.21	1.39	1.51	1.73
SHEPODY	26.5	25.4	1.26	0.36	1.30	1.65
sig (Pr=)	0.6767	0.7898	0.5758	0.7987	0.0543	0.5678
lsd (5%)	n.s.[5]	n.s.	n.s.	n.s.	n.s.	n.s.
CULT X TRT						
sig (Pr=)	0.0106	0.0099	0.0079	0.0020	0.0064	0.0464
CV (%)	9.5	4.9	27.7	34.8	26.7	27.3

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[1] Days to 50% Emergence - days from planting to 50% emergence of final plant stand.

[2] Plant Density - 1,000 plants/ha.

[3] Seed Piece Decay - 1 = no decay to 5 = completely decayed.

[4] Rhizoctonia Canker - 1 = no necrosis to 5 = stem completely girdled.

[5] n.s. - non-significant

The CONTROL treatment showed a higher seed piece decay rating at both sampling dates compared with all other treatments, including the CHECK (Table 1). In both cases, the C X T was significant. The CONTROL treatment had a higher seed piece decay rating than all other treatments with Shepody. Treatment had no significant effect on seed piece decay with Russet Burbank. All fungicide treatments, including the control, reduced the level of rhizoctonia canker at the two sampling dates, although the C X T was significant. No significant differences between treatments were observed for Shepody. However, with Russet Burbank, the CHECK treatment showed the highest level of rhizoctonia infection at both dates. The iprodione treatment (EXP-80590A) had a higher rhizoctonia canker rating than all other seed piece treatments but lower than the rating for the CHECK treatment. The number of main stems per plant was lower for the treatments that included triticonazole than the CONTROL and EXP-60590A (iprodione alone) treatments (Table 2). The number of main stems was higher for Russet Burbank than Shepody. The C X T interaction was significant. For Russet Burbank, the CONTROL and EXP-80590A treatments had higher main stem numbers than the CHECK, and the treatments that included triticonazole, had lower main stem numbers than the CHECK. For Shepody, the main stem numbers of EXP-80590A, and of EXP-80590A and CONTROL, were higher than all other treatments on June 30 and September 22, respectively.

Table 2. Effects of seed piece treatment and cultivar on main stem number, incidence of tuber deformities, severity of black scurf.

Treatment	Main stem number[1] June 30	 Sept 22	Deformities[2] % of tubers	Black Scurf[3] % of tuber surface
CHECK	2.37 b	2.18 b	4.63 cd	2.38
CONTROL	2.88 a	2.63 a	2.75 d	1.13
EXP-80576A	2.12 bc	2.00 bc	5.25 bcd	2.38
EXP-80577A	2.02 bc	1.98 bc	7.50 ab	1.50
EXP-80578A	1.94 c	1.91 c	8.13 a	0.13
EXP-80590A	3.03 a	2.62 a	3.13 d	2.88
EXP-80591A	2.00 c	1.92 c	5.88 abc	0.88
sig (Pr=)	0.0001	0.0001	0.0016	0.1819
lsd (5%)	0.363	0.262	2.503	n.s.[4]
CULTIVAR				
BURBANK	2.64 a	2.48 a	5.58	0.89 b
SHEPODY	2.04 b	1.88 b	5.07	2.29 a
sig (Pr=)	0.0001	0.0001	0.4426	0.0267
lsd (5%)	0.194	0.140	n.s.	1.213
CULT X TRT				
sig (Pr=)	0.0012	0.0016	0.3997	0.6055
CV (%)	14.8	11.5	44.8	135.9

[1] Main stem number - number of main stems (stems originating directly from the seed piece) per plant.

[2] Deformities - percent of tubers with secondary growth or growth cracks.

[3] Black Scurf - mean percentage of tuber surface cover with black scurf.

[4] n.s. - non-significant

The percent of tubers with deformities tended to be higher for the treatments that included triticonazole, although not always significantly (Table 2). The highest incidence of tuber deformities occurred with seed pieces treated with EXP-80578A, which had the highest rate of triticonazole. The percentage of tuber surface area with black scurf was higher for Shepody than Russet Burbank, but not affected by seed piece treatment (Table 2). Marketable tuber yield was not affected by cultivar or treatment (Table 3). However, the bonus (>284 g) tuber yield was greater for Shepody than Russet Burbank, and tended to be higher with the treatments that included triticonazole. The specific gravity of Russet Burbank was greater than Shepody (Table 3). Treatments that included triticonazole tended to have a lower specific gravity than the CHECK, CONTROL and EXP-80590A treatments. Seed piece treatment had no significant effect on incidence of hollow heart, fry colour from storage, or gross return to the producer based on local processor contract prices (Table 3). Russet Burbank had a lighter fry colour than

Shepody.

CONCLUSIONS: Triticonazole alone, or in combination with iprodione, at the rates used in this study exhibited some phytotoxic effects on Russet Burbank and to a lesser extent on Shepody. Triticonazole delayed plant emergence, reduced plant density and reduced the number of main stems per plant, relative to the CHECK, CONTROL and EXP-80590A (iprodione alone) treatments. No differences were observed between treatments for seed piece decay in Russet Burbank, or for rhizoctonia canker in Shepody. However, for Shepody, the CONTROL treatment resulted in greater seed piece decay, while seed piece decay for all other treatments was not significantly different from the CHECK. Triticonazole treatments were comparable to the CONTROL in reducing the degree of rhizoctonia canker in Russet Burbank, and showed better control than the CHECK and EXP-80590A treatments. Seed piece treatments did not affect level of black scurf on tubers from the 1994 study. Use of triticonazole increased the incidence of tuber deformities. While marketable yield was not affected by seed piece treatment, triticonazole reduced the number of tubers set and showed increases in average tuber weight (data not shown) and bonus (>284 g) tuber yield.

Table 3. Effects of seed piece treatment and cultivar on marketable (>1f ")and bonus (>284 g) tuber yield, specific gravity, fry colour and gross return to grower.

	Tuber Yield	(T/ha)	Specific	Hollow	Fry	Gross
Treatment	Marketable	Bonus	Gravity	Heart[1]	Colour[2]	Return[3]
CHECK	43.2	25.7 bc	1.087 a	1.06	3.98	5508
CONTROL	46.7	26.1 bc	1.085 ab	0.44	4.66	5985
EXP-80576A	47.4	32.7 ab	1.083 abc	0.74	4.10	6081
EXP-80577A	46.1	32.7 ab	1.080 c	1.78	4.13	5851
EXP-80578A	46.8	34.5 a	1.082 bc	1.19	4.20	6007
EXP-80590A	42.2	22.4 c	1.086 ab	0.10	3.99	5459
EXP-80591A	45.2	31.1 ab	1.082 abc	0.84	4.18	5809
sig (Pr=)	0.7413	0.0250	0.0495	0.5882	0.1092	0.7873
lsd (5%)	n.s.[4]	7.55	0.0044	n.s.	n.s.	n.s.
CULTIVAR						
BURBANK	45.0	24.2 b	1.089 a	1.05	4.42 a	5688
SHEPODY	45.8	34.5 a	1.078 b	0.71	3.92 b	5943
sig (Pr=)	0.6812	0.0001	0.0001	0.4771	0.0006	0.3343
lsd (5%)	n.s.	4.03	0.0024	n.s.	0.256	n.s.
CULT X TRT						
sig (Pr=)	0.3690	0.1803	0.5842	0.2876	0.6221	0.4037
CV (%)	16.1	24.5	0.4	195.1	10.9	16.5

[1] Hollow Heart - percent of total yield by weight.

[2] Fry Colour - 7 = USDA 000 (light) to 1 = USDA 4 (dark).

[3] Gross Return - return to grower ($/ha) based on local processor contract prices.

[4] n.s. - non-significant

#129 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 362-1241-8501

CROP: Potato, cvs. Russet Burbank and Shepody

PEST: *Rhizoctonia solani* Kühn, *Fusarium spp.*

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TITLE: EFFICACY OF TRITICONAZOLE AND IPRODIONE AGAINST SEED PIECE DECAY AND RHIZOCTONIA ON POTATO, 1995

MATERIALS: Seed piece treatments included the following:
CONTROL 1, Easout 10D (10% thiophanate-methyl) @0.5kg/100kg seed;
CONTROL 2, Tuberseal Potato Seed Piece Dust (16% mancozeb) @0.5 kg/100 kg seed;
TRTMT 3, Triticonazole (0.133%) + iprodione (0.33%) @0.75 kg/100 kg seed;
TRTMT 4, Triticonazole (0.133%) + iprodione (0.67%) @0.75 kg/100 kg seed;
TRTMT 5, Triticonazole (0.267%) + iprodione (0.33%) @0.75 kg/100 kg seed;
TRTMT 6, Triticonazole (0.267%) + iprodione (0.67%) @0.75 kg/100 kg seed;
TRTMT 7, Triticonazole (0.33%) @ 0.75 kg/100 kg seed; **CHECK**, untreated seed.

METHODS: The trial was conducted at the AAFC, Research Centre, Morden in 1995. The trial was planted on a sandy loam soil. Spring soil sampling revealed the following nutrient levels: 47 kg N, 72 kg P_2O_5, 316 kg K_2O and 47 kg S /ha). Solution fertilizer (129 kg N, 59 kg P_2O_5 and 157 kg K_2O/ha) was broadcast and incorporated pre-plant. Seed tubers were hand cut to produce seed pieces between 40 and 80 g in weight. Seed pieces were put into a large plastic bag and weighed. Seed piece treatment was added to the bag, and the bag shaken until the seed pieces were uniformly covered with the seed piece treatment. Four replicates were planted in an RCBD experimental design with two factors, seed piece treatment and cultivar. Individual plots consisted of 4 rows, 10m in length, with 1 m between row centres. Three m were left between adjacent plots to allow space for a tractor mounted sprayer. The trial was planted on May 16 using a plot planter, with seed pieces spaced every 38 cm. Plant emergence in each plot was counted three times per week, beginning when plant emergence was first observed, and continuing until emergence exceeded 50% in all plots. A final plant stand count was taken on June 21. Three m from an outside row of each plot were dug on June 13 and June 27. On each date, seed pieces were rated for: emergence (yes or no); seed piece decay (1 = no decay to 5 = completely decayed), and rhizoctonia canker (1 = no necrosis to 5 = sprouts completely girdled), resulting from natural infection; and number of main stems (stems originating directly from the seed piece) emerged. Row-cultivation/hilling was carried out in late June. Applications of sethoxydim and metribuzin were made to control weeds, and deltamethrin and endosulfan were applied to control Colorado potato beetle. Regular applications of chlorothathalonil or mancozeb/metalaxyl were made to control early and late blight. The centre two rows of each plot were harvested on September 21 and the entire harvested yield was placed into storage until grading in mid-October. Grading was carried out simulating procedures used by a local french fry processor. Tuber yield, tuber size distribution, and incidence of hollow heart were used in calculating a gross return to the grower for each treatment. A sample of 25 tubers was rated for: percentage of tubers with tuber deformities (secondary growth or growth cracks) and greening.

RESULTS: All data was subject to analysis of variance, followed by mean separation test (least significant difference) only if probability values from the analysis of variance were • 0.05. Trtmt 7, the treatment with the highest concentration of triticonazole, had slower plant emergence and a lower plant density than both CONTROL and CHECK treatments (Table 1). Trtmts 5, 6 and 7 expressed later plant emergence, and Trtmts 6 and 7 had a lower final plant density than the CHECK. Shepody emerged about 2 d later, and had a lower final plant density, than Russet Burbank.

Table 1. Effects of seed piece treatment and cultivar on days to 50% plant emergence, plant density, seed piece decay, and rhizoctonia stem canker

Treatment	Days to 50% Emergence[1]	Plant Density	Seed Piece Decay[2] June 13	Seed Piece Decay[2] June 27	Rhizoctonia Canker[3] June 13	Rhizoctonia Canker[3] June 27
TREATMENT						
CONTROL 1	26.5 bcd	26.7 a	1.05	1.20	1.63	2.74
CONTROL 2	26.8 bcd	25.9 abc	1.08	1.30	1.60	2.38
TRTMT 3	26.0 d	26.3 ab	1.00	1.13	1.54	2.70
TRTMT 4	26.4 cd	25.6 bc	1.00	1.16	1.48	2.73
TRTMT 5	27.4 abc	25.9 abc	1.00	1.15	1.49	2.27
TRTMT 6	27.8 ab	25.1 c	1.00	1.10	1.18	2.32
TRTMT 7	28.4 a	24.0 d	1.00	1.11	1.53	2.43
CHECK	25.9 d	26.4 ab	1.00	1.35	2.21	2.88
sig (Pr=)	0.0064	0.0003	0.5084	0.4012	0.0656	0.0696
lsd (5%)	1.28	1.58	n.s.	n.s.	n.s.	n.s.
CULTIVAR						
BURBANK	25.9 b	25.9 a	1.00	1.17	1.59	2.66
SHEPODY	27.9 a	25.2 b	1.08	1.20	1.56	2.45
sig (Pr=)	0.0001	0.0375	0.3021	0.6722	0.9675	0.0556
lsd (5%)	0.64	0.79	n.s.	n.s.	n.s.	n.s.
CULT X TRT						
sig (Pr=)	0.9789	0.2408	0.8374	0.1216	0.3937	0.9026
CV (%)	4.5	3.6	8.8	20.2	33.7	16.6

[1] Days to 50% Emergence - days from planting to 50% emergence of final plant stand.

[2] Plant Density - 1,000 plants/ha.

[3] Seed Piece Decay - 1 = no decay to 5 = completely decayed.

[4] Rhizoctonia Stem Canker - 1 = no necrosis to 5 = stem completely girdled.

[5] n.s. - non-significant.

On June 13 and June 27, Trtmts 5, 6 and 7 and Trtmts 5 and 7, respectively, had the fewest main stems per plant (Table 2). Shepody had fewer main stems per plant than Russet Burbank. On June 13, triticonazole at the higher rates reduced main stem number with Russet Burbank, but seed piece treatment had no effect on Shepody. The thickness of the largest main stem, measured at ground level, was thicker for Shepody than Russet Burbank (Table 2). Trtmt 7 had thicker main stems on June 13 than all other seed piece treatments. On June 27 there were no significant differences between treatments. Russet Burbank showed no significant response to treatment for main stem thickness on June 13. Seed piece decay ratings taken on June 13 and June 27 were low (Table 1), with no significant responses to treatment, cultivar. Treatment effect for rhizoctonia canker was non-significant at the 5% level (Table 1). However, all seed piece treatments had a lower rating than the untreated CHECK for rhizoctonia canker. The percent of tubers with deformities (secondary growth and growth cracks) was not affected by treatment or cultivar (Table 2).

Table 2. Effects of seed piece treatment and cultivar on main stem number, incidence of tuber deformities, severity of black scurf.

	Main stem number[1]		Main stem thickness[2]		Deformities[3]
Treatment	June 13	June 27	June 13	June 27%	of tubers
TREATMENT					
CONTROL 1	2.67 a	2.99 a	7.86 b	9.29	3.0
CONTROL 2	2.63 a	2.86 ab	7.78 bc	9.68	5.5
TRTMT 3	2.56 a	2.84 ab	7.41 bc	8.91	5.5
TRTMT 4	2.62 a	2.81 abc	7.46 bc	9.19	6.9
TRTMT 5	2.10 bc	2.31 cd	7.62 bc	10.06	9.0
TRTMT 6	2.16 b	2.48 bcd	7.36 c	9.92	8.0
TRTMT 7	1.78 c	2.11 d	8.59 a	10.14	9.0
CHECK	2.56 a	2.51 bcd	7.78 bc	9.94	6.0
sig (Pr=)	0.0003	0.0069	0.0012	0.6535	0.4762
lsd (5%)	0.412	0.441	0.464	n.s.[4]	n.s.
CULTIVAR					
BURBANK	2.78 a	2.92 a	6.33 b	8.79 b	6.1
SHEPODY	1.93 b	2.27 b	9.20 a	10.53 a	7.1
sig (Pr=)	0.0001	0.0001	0.0001	0.0002	0.5386
lsd (5%)	0.182	0.225	0.240	0.794	n.s.
CULT X TRT					
sig (Pr=)	0.0018	0.2465	0.0361	0.1701	0.7650
CV (%)	14.5	16.4	5.9	15.7	88.7

[1] Main stem number - number of main stems (stems originating directly from the seed piece) per plant.

[2] Main stem thickness - diameter (mm) at ground level of the dominant main stem from each seed piece.

[3] Deformities - percent of tubers with secondary growth or growth cracks.

[4] n.s. - non-significant

Marketable (>48 mm) and bonus (>284 g) tuber yield were not affected by seed piece treatment (Table 3). The bonus yield of Shepody was greater than for Russet Burbank, but the marketable yield of the two cultivars was not significantly different. Russet Burbank had a higher specific gravity than Shepody (Table 3). The specific gravity of Trtmt 7 was lower than all other seed piece treatments. The incidence of hollow heart (% of total weight) was low and not affected by seed piece treatment or cultivar (Table 3). The gross return to the producer, based on a local processor contract, was not affected by seed piece treatment or cultivar.

CONCLUSIONS: In a study conducted in 1994, triticonazole, alone or mixed with iprodione, expressed some phytotoxic effects of delayed emergence, reduced plant stands, fewer main stem numbers, and an increase in tuber deformities. These phytotoxic effects tended to be more severe as the concentration of triticonazole increased. Russet Burbank appeared to be more susceptible to these phytotoxic effects. It was also observed, although no data was collected, that stems of triticonazole treated seed pieces appeared thicker and more brittle. In this study, the highest concentration of triticonazole tested, 0.33%, was equivalent to the lowest rate tested in 1994. Some evidence of phytotoxicity was observed, including delayed plant emergence, reduced plant density and reduced number of main stems. These effects were most evident at the highest concentration of triticonazole. This treatment also produced the thickest main stems, although differences between the other treatments which included triticonazole and the CONTROL and CHECK treatments were not evident. The triticonazole treatments appeared as effective as the CONTROL treatments in controlling rhizoctonia canker due to natural infection, although treatments were not significantly different at the 5% level. Seed piece decay ratings were low, and differences between treatments were not significant. The gross return to the producer, and factors used in calculating return, including marketable tuber yield, bonus tuber yield (Russet Burbank only), and incidence of hollow heart, were not affected by seed piece treatment.

Table 3. Effects of fungicide treatment on marketable (>48 mm)and bonus (>284 g) tuber yield, specific gravity, fry colour and gross return to grower.

	Tuber Yield (T/ha)		Specific	Hollow	Gross
Treatment	Marketable	Bonus	Gravity	Heart[1]	Return[2]
TREATMENT					
CONTROL 1	24.7	8.5	1.086 a	0.61	3181
CONTROL 2	25.2	8.9	1.088 a	0.14	3186
TRTMT 3	26.6	8.9	1.088 a	1.95	3362
TRTMT 4	23.0	8.0	1.088 a	0.00	2920
TRTMT 5	27.7	10.4	1.089 a	0.28	3458
TRTMT 6	27.0	11.4	1.086 a	0.97	3401
TRTMT 7	26.1	11.7	1.082 b	0.17	3394
CHECK	27.0	10.4	1.089 a	0.20	3515
sig (Pr=)	0.6459	0.4156	0.0127	0.3958	0.5684
lsd (5%)	n.s.	n.s.	0.0041	n.s.	n.s.
CULTIVAR					
BURBANK	26.3	7.3 b	1.090 a	0.84	3241
SHEPODY	25.6	12.4 a	1.084 b	0.25	3379
sig (Pr=)	0.5473	0.0001	0.0001	0.2101	0.3791
lsd (5%)	n.s.	1.89	0.0020	n.s.	n.s.
CULT X TRT					
sig (Pr=)	0.7479	0.6079	0.3994	0.1810	0.5788
CV (%)	19.8	36.6	0.4	312.0	17.9

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[1] Hollow Heart - percent of total yield by weight.

[2] Gross Return - return to grower based on local processor contract.

[3] n.s. - non-significant

#130 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1251-9301

CROP: Potato, cv. Kennebec

PEST: Common scab, *Streptomyces scabies*
Stem rot, black scurf, *Rhizoctonia solani*

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TITLE: EFFICACY OF POTATO SEED PIECE FUNGICIDE TREATMENTS FOR CONTROL OF TUBER DISEASES, 1995

MATERIALS: CAPTAN (7.5%); RIZOLEX (tolclofos-methyl 10%); MONCEREN (DS 12.5%); EASOUT 70W (thiophanate-methyl); FLUAZINAM (500F)

METHODS: The trial was conducted at the Harrington Research Farm using the cultivar, Kennebec on a site which had not been cropped to potatoes for at least 8 years. Standard production techniques were followed with respect to fertility, weed control (SENCOR), and for control of potato insects (THIODAN and NOVODOR) and late blight (BRAVO). A complete randomized block design was used with 6 replicates, each plot being a single row 12 m long. The first 6 m of row was used for destructive sampling for disease severity measurements on August 23. The remaining 6 m, separated by two tubers of Red Pontiac from that previously sampled, was harvested for yield and disease severity ratings of tubers. Checks (untreated) utilized both healthy, and infected tubers which bore visible sclerotia of *R. solani* to a moderate level of infection. All fungicide treatments were applied to the tubers bearing sclerotia. The FLUAZINAM treatments were applied using a back-pack sprayer at planting, before hilling, and later by spraying along the top of the hill and under the lower foliage. A top-kill (REGLONE) was applied on September 23 with tuber harvest on October 20. Control of *R. solani* on vegetative plant parts was based on emergence, stand, vigour and a disease severity rating on ten stems, and associated roots and stolons from each plot using a 1-7 scale. Tubers were rated for common scab and black scurf by estimating the percentage of the surface of 15 tubers from each plot covered with characteristic lesions. In addition, disease severity was also rated on a 1-4 scale for size of *R. solani* sclerotia; for common scab a severity scale of 1-2 was utilized based on lesion depth. Yield was reported on standard grades of tubers.

RESULTS: As presented in the table.

CONCLUSIONS: Significant differences generally were present in performance of diseased seed tubers vs tubers selected as a healthy check. RIZOLEX was associated with possibly a reduced emergence rate and slightly healthier stems and stolons of treated plants. EASOUT also may have suppressed symptoms of *Rhizoctonia* infection on stems and stolons. Severity of common scab did not develop to appreciable levels and no significant difference in disease development on tubers could be detected at harvest among treatments. However, *Rhizoctonia* infection of tubers scored at harvest indicated that RIZOLEX and MONCEREN at the lower application level reduced the severity of tuber contamination by *R. solani* sclerotia (black scurf). These treatments were however associated with reduced marketable yields especially at the higher application rates.

The value of a reduction in tuber contamination with sclerotia is possible as daughter progeny may show improvements in yield as suggested by improved performance of healthy checks. Further studies, including storage health of harvested tubers are underway.

Table 1. Influence of fungicide seed piece treatments on emergence and disease severity of Kennebec potatoes.

Treatment	Rate	Emergence	Disease severity (1-7)		
	g ai/100 kg	plant/ha+	Root	Stem	Stolon
Healthy tubers					
CHECK	Nil	37.2	2.2	2.3	2.4
Diseased tubers					
CHECK	Nil	37.5	2.6	2.7	3.2
CAPTAN	1000	36.1	2.6	2.7	3.5
RIZOLEX	10	29.9	2.4	2.4	2.5
RIZOLEX	20	32.4	2.4	2.5	2.5
MONCEREN	150	36.1	2.3	2.6	2.8
MONCEREN	250	30.3	2.4	2.8	2.9
EASOUT	500*	31.4	2.2	2.1	2.6
FLUAZINAM	2L+1L**	36.5	2.2	2.9	3.0
FLUAZINAM	1L(x3)***	36.5	2.5	2.7	3.3
CV		11	10	10	17
LSD (0.05)		7.3	ns	0.31	0.56

* g product.
** 2 L/ha product applied at planting followed by 1 L/ha at hilling.
*** 1 L applied at 45, 60 and 75 d after planting + X 1000 = plants/ha.

Table 2. Tuber disease and yield of Kennebec tubers as influenced by fungicide seed piece treatments.

Treatment	Rate g ai/100 kg	Tuber disease Scab	 Scurf	Yield (T/ha) Marketable	 Total
Healthy tubers					
CHECK	Nil	2	10	41.6	50.9
Diseased tubers					
CHECK	Nil	2	34	37.5	49.3
CAPTAN	1000	1	41	38.4	51.6
RIZOLEX	10	2	14	31.3	38.4
RIZOLEX	20	2	11	28.9	40.2
MONCEREN	150	2	17	39.2	48.1
MONCEREN	250	2	24	25.5	38.1
EASOUT	500	1	23	37.1	45.2
FLUAZINAM	2+1L	1	34	43.4	52.2
FLUAZINAM	1L(X3)	2	40	41.4	49.6
CV		48	42	19	14
LSD (0.05)		ns	11.9	8.12	5.72

Scab, scurf - maximum severity values of 200 and 400 respectively.
See Table 1 for additional footnotes.

#131 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Potato, cv. Kennebec

PEST: *Streptomyces scabies*
Rhizoctonia solani Kuhn (AG 3)
Verticillium species

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TITLE: EFFICACY OF CHEMICAL CONTROL OF POTATO DISEASES CAUSED BY SOIL-BORNE FUNGAL PATHOGENS-1994

MATERIALS: Thiophanate-methyl (Easout10 D: 10%d, Ciba-Geigy Ltd.) applied at 0.5 g a.i. kg^{-1} seed and experimental materials: 80576A, 80577A, 80578A, 80590A and 80591A (confidential materials, Rhone-Poulenc) applied at 2.5, 5.0, 7.5, 5.0, and 10.0 g a.i. 100 kg^{-1} seed, respectively and Gaozhimo (coconut extract, Masbrane 1:200 L water, Aefa-Chemi) applied as a seed dip or soil drench.

METHODS: Elite 3 seed (cv Kennebec) was used that had received no "fall" fungicide treatment prior to storage. Immediately after cutting and just before planting, the seed was treated with fungicides. Fungicide treatments were applied by shaking in a plastic bag for 3-5 min. the seed and fungicide treatment. As controls, some seed were not treated with fungicides. Immediately after treating, the seed was hand-planted in 3.0 m rows with 30 cm in-row and 0.9 m between-row spacings in a randomized complete block design with 4 replicate blocks in 1994. After planting, Gaozhimo was applied to the soil surface of the potato row with a six litre hand-held pesticide sprayer. Sufficient Gaozhimo was applied to moisten the soil surface of the potato hill (0.3 L m^{-1} row). This treatment was repeated for some plots at flowering and 2 weeks after flowering. Recommended crop management practices were followed. Plant emergence, vigour and disease determinations were made throughout the season. Top desiccant was applied about mid-September and plots were harvested two weeks later. Post-harvest disease incidence (%) and severity (0-4 scale) assessments were made for tuber surface disorders such as common scab and for tuber stem-end vascular tissue discolouration (after removing a 3-5 mm cross-section) after grading.

RESULTS: All data was subjected to analysis of variance and mean separation tests (Tables 1-4). Plant emergence was rapid but early vigour was reduced with 80576A, 80577A, 80578A and 80591A seed treatments (Table 1). The number of "healthy" plants were also significantly reduced by 80591A but were significantly improved by 80590A and Gaozhimo seed treatment. The number of "weak" plants were not significantly affected by any of the treatments. For total plant stand, 80578A and 80591A had significant reductions as compared to Easout, 80590A, and the three Gaozhimo treatments. Seed rots were generally caused by Rhizoctonia but a few had bacterial rots. 80576A, 80578A and 80591A had significantly high incidence. Plant wilt incidence increased throughout the season but significant differences were only found with 80578A and 80591A which had less than some other treatments (Table 2). No significant yield differences were found among the various treatments except for the smallest size group (<55 mm) for which 80576A, 80577A, 80578A, and 80591A had significantly less (Table 3). No significant differences among the treatments were obtained for the severity of black scurf, fusarium rots, bacterial disorders and tuber stem-end vascular discolouration. However, the incidence of common scab on tubers <55 mm was significantly reduced by all treatments except 80576A, 80577A and 80578A (Table 4).

CONCLUSIONS: Some significant differences were obtained among the treatments studied with some treatments, such as 80590A and Goazhimo seed dip, enhancing plant growth and reducing incidence of tuber disorders. However, further studies will be conducted prior to development of recommendations for the treatments studied.

Table 1. Effects of tuber and soil treatments on potato growth - 1994.

Treatment	Plant Vigour (%) 23 June	Healthy Plants (%) 5 July	Weak Plants(%) 5 July	Plant Stand (%) 5 July	Seed Rot (%) 5 July
Untreated	69	84	9	93	7
Easout	76	93	7	100	0
80576A	58	76	16	91	9
80577A	47	82	11	93	7
80578A	40	80	7	87	13
80590A	64	96	4	100	0
80591A	33	73	11	84	16
GaozhimoP	71	96	4	100	0
GaozhimoP&F	62	89	11	100	0
GaozhimoP&F&2F	80	91	4	96	4
Lsd (P=0.05)	17.2	10.7	NS	8.1	8.1

Note: For Gaozhimo treatments P = planting, F = flowering, 2F = 2 weeks post-flowering. NS = not significantly different.

Table 2. Effects of tuber and soil treatments on potato wilt - 1994.

Treatment	Wilt (%) 19 July	Wilt (%) 8 August	Wilt(%) 18 August	Wilt(%) 1 September
Untreated	0	72	93	91
Easout	4	64	69	100
80576A	2	67	93	91
80577A	0	21	53	89
80578A	0	82	95	87
80590A	2	71	87	100
80591A	0	38	62	71
GaozhimoP	0	67	93	100
GaozhimoP&F	0	20	58	100
GaozhimoP&F&2F	2	48	76	96
Lsd (P=0.05)	NS	NS	NS	12.2

Note: For Gaozhimo treatments P = planting, F = flowering, 2F = 2 weeks post-flowering. NS = not significantly different.

Table 3. Effects of tuber and soil treatments on potato yields - 1994.

	Tuber Yields (t ha^{-1})		
Treatment	<55 mm	>55 mm	Total
Untreated	8.7	14.1	23.6
Easout	9.1	16.6	27.9
80576A	5.6	14.2	23.4
80577A	4.9	19.3	29.1
80578A	5.9	12.7	20.9
80590A	10.7	13.3	26.0
80591A	4.4	15.3	27.8
GaozhimoP	6.7	16.2	26.9
GaozhimoP&F	9.4	20.7	32.4
GaozhimoP&F&2F	9.7	16.3	28.0
Lsd (*P*=0.05)	2.46	NS	NS

Note: For Gaozhimo treatments P = planting, F = flowering, 2F = 2 weeks post-flowering. NS = not significantly different.

Table 4. Effects of tuber and soil treatments on tuber diseases - 1994.

	Common Scab (%)		Black Scurf (%)	Stem-end Discolouration
Treatment	<55 mm*	>55 mm*	>55 mm*	>55 mm*
Untreated	80	80	84	78
Easout	53	67	67	93
80576A	64	64	73	91
80577A	62	73	58	73
80578A	76	82	49	100
80590A	22	45	86	91
80591A	36	42	60	76
GaozhimoP	47	58	69	96
GaozhimoP&F	56	76	64	76
GaozhimoP&F&2F	47	73	62	84
Lsd (*P*=0.05)	18.3	NS	NS	NS

* Tubers sized <55 mm or >55 mm.

Note: For Gaozhimo treatments P = planting, F = flowering, 2F = 2 weeks post-flowering. NS = not significantly different.

PLANT PATHOLOGY / PHYTOPATHOLOGIE

CEREAL AND FORAGE CROPS / CÉRÉALES ET CULTURES FOURRAGÈRES

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#132 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 375-1431-7631

CROP: Alfalfa

PEST: Blossom blight, *Botrytis cinerea* and *Sclerotinia sclerotiorum*

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TITLE: FUNGICIDE APPLICATION REDUCED BLOSSOM BLIGHT INCIDENCE IN ALFALFA

MATERIALS: BENLATE (benomyl, 50% WP); BRAVO 500 (chlorothalonil, 50% F); ROVRAL FLO (iprodione, 25% F)

METHODS: The effect of fungicide application on flower contamination by *Botrytis cinerea* and *Sclerotinia sclerotiorum* was assessed in commercial alfalfa seed production fields at 9 sites in 1995; 4 in Manitoba (MB), 3 in Saskatchewan (SK) and 2 in Alberta (AB). In SK and AB, BENLATE (0.8 kg a.i. ha$^{-1)}$, BRAVO (1.4 kg a.i. ha^{-1}), and ROVRAL (1.1 kg a.i. ha^{-1}) were applied when the crop was in full flower in early to mid July. A second application was made about 10 d later. One and two applications of each fungicide were compared with an nonsprayed control. The plots (• 100 m^2 each) were arranged in a RCBD or split plot design with 2 to 4 replications per site. In MB, one application of Benlate and Bravo was assessed in strip blocks with 2 replications. The oldest unfertilized floret from 20 racemes per plot per sampling date were plated onto acidified PDA, without surface sterilization. The incidence of *B. cinerea* and *S. sclerotiorum* was assessed about 10 d after collection. At Macdowall SK and Pilger SK, seed samples were harvested from two 1 m^2 quadrants per plot. At Watson SK, a 40 m^2 area of each plot was harvested.

RESULTS: The incidence of *S. sclerotiorum* was low (<20%) at all sites and there was no treatment effect for this pathogen (data not shown). The incidence of *B. cinerea* was high (>70%) at two of three sites in SK (Table 1) and at one site in AB (Table 2); blossom blight symptoms, including flower abortion and colonization of flowers by fungal hyphae, were observed at Watson SK and Eaglesham AB. Benomyl reduced levels of *B. cinerea* at two of three sites where incidence was high. In most instances, alfalfa seed yield with a single application of fungicide was similar to or better than two applications (data not shown), so the data was combined for presentation. Application of benomyl or chlorothalonil improved yield at Watson by more than 50%. A similar trend was noted at Pilger SK, but the differences were not significant.

CONCLUSIONS: BENLATE consistently reduced the incidence of *Botrytis cinerea* in flowers from fields where levels were high, and occasionally reduced its incidence in fields with low levels. BENLATE and BRAVO improved seed yield at one site (Watson) where levels were high. BRAVO did not generally reduce incidence of *B cinerea* in the oldest flowers, but may have protected newly-opened flowers from infection. ROVRAL rarely had an impact on *B cinerea.*

ACKNOWLEDGEMENT: Thanks to the CSGA, ADF, AARI and MII for financial assistance, ISK BioSciences and Rhône-Poulenc for fungicides, Dr. S.R. Smith and R. Linowski for their input and to K. Bassendowski and F. Katepa-Mupondwa for technical assistance.

Table 1. Incidence of *Botrytis cinerea* (%) in flowers and impact on seed yield (kg/ha) at three sites in Saskatchewan in 1995.

Location	Date	Benlate	Bravo	Rovral	Control
	% Botrytis				
Watson	July 10	9 *	59 *	53 *	79
	July 27	93	96	95	93
Pilger	July 27	59	73	73	48
Macdowall	July 19	5	13	4	3
	August 1	17	26	23	13
	Seed Yield (kg/ha)				
Watson		150 *	150 *	110	100
Pilger		170	180	120	100
Macdowall		240	200	210	250

* Value differ (P <0.05) from the control (lower for infection, higher for yield), based on single degree of freedom contrasts in ANOVA.

Table 2. Incidence of *Botrytis cinerea* (%) in alfalfa flowers at sites in Manitoba and Alberta in 1995.

Location	Date	Benlate	Bravo	Rovral	Control
Alberta					
Brooks	July 18	6	4	9	8
	July 24	2 *	11	7	9
	August 8	11 *	15	17	18
	August 17	13 *	19	16	19
Eaglesham	July 13	14 *	42	21 *	34
	July 21	19 *	54	45	44
	July 26	73 *	92	80	90
	August 2	65	78	73	76
	August 10	38	39	46	43
Manitoba					
Miami	July 24	0.4	2	-	0.4
Arborg	July 25	2	0	-	2
Lac DuBonnet	July 26	18	14	-	22
Seven Sisters	July 26	6 *	6 *	-	24

* Value differ ($P < 0.05$) from the control (lower for infection, higher for yield), based on single degree of freedom contrasts in ANOVA.

#133 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. Summit

PEST: Barley leaf stripe, *Pyrenophora graminea*

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TITLE: THE EFFECTS OF FUNGICIDE SEED TREATMENTS ON BARLEY LEAF STRIPE AT FOUR CANADIAN LOCATIONS, 1995

MATERIALS: AGROX NM (maneb, 50%); UBI-2051-1 (VITAFLO 280, carbathiin, 14.9% + thiram, 13.2%); UBI-2092-1 (VITAFLO 250, carbathiin, 25.3%); UBI-2379 (metalaxyl, 317 g/L); UBI-2383-1 (triadimenol, 317 g/L); UBI-2454-1 (RH3866, myclobutanol, 50 g/L); UBI-2584-3 (tebuconazole, 8.37 g/L); TF-3716 (mancozeb, 300 g/L); ROVRAL 4F (iprodione, 41.6%); AGSCO DB-GREEN L (maneb, 323 g/L + lindane 108 g/L)

METHODS: Barley leaf stripe infected seed was treated with the above materials at the rates listed in the tables below at the Eastern Cereal and Oilseed Research Centre in Ottawa. After treatment seed was sent for seeding in Lacombe, Winnipeg, Ottawa and Charlottetown. Single row plots, replicated 4 times, were established at each location. Row lengths were 3 m, 4.5 m, 3 m and 1.5 m in Lacombe, Winnipeg, Ottawa and Charlottetown respectively. Shortly after emergence stand counts were take on 1 m of row/plot. When barley stripe symptoms were well expressed the number of infected plants per row was determined.

RESULTS: With the exception of AGROX NM and the UBI-2092-1 + UBI-2379 combinations at Winnipeg no treatment had a significant impact on emergence when compared to the check treatment ($P = 0.05$). The above two treatments did result in a significant emergence benefit at the single location.

Most of the test materials resulted in significant reductions in the level of barley leaf stripe, at three of the four test locations. The products which provided the overall best control potential were AGROX NM, VITAFLO 280 (UBI-2051-1), UBI-2383-1, UBI-2584, ROVRAL, UBI-2383-1 + VITAFLO 280 (UBI-2051-1) and UBI-2092-1 + UBI-2454-1. Each of these treatments reduced disease levels to a point which was not significantly different from treatments which resulted in 100% disease control. TF-3716 and UBI-2092-1 were not significantly different from the untreated control at Winnipeg. AGSCO DB-GREEN was effective at three locations, but not as effective as some of the better treatments at Charlottetown. UBI-2379 contributed to a significant increase (35 to 100%) in leaf stripe, in three of the test locations. UBI-2379 in combination with VITAFLO 250 was not significantly different from VITAFLO 250 applied alone with the exception of Winnipeg where disease control from the combination was significantly less that from VITAFLO 250 alone.

CONCLUSIONS: Most treatments were effective at disease control, with the notable exception of UBI-2379 (metalaxyl). The reason why UBI-2379 increased barley leaf stripe is not clear. In part, it may be due to improved emergence or early survival of infected plants compared to other treatments. However the number of infected plants was to small for this to be reflected in any significant emergence count differences.

Table 1. Influence of seed treatments on barley emergence (plants/row).

Treatment	Rate (g ai/kg seed)	Location			
		Ottawa	Lacombe	Winnipeg	Charlottetown
Untreated	0.00	42	36	105	84
AGROX NM	1.30	40	41	138	106
UBI-2051-1	1.04	32	37	115	101
UBI-2092-1	0.51	32	39	109	103
UBI-2379	0.30	43	36	116	98
UBI-2383-1	0.15	36	37	97	94
UBI-2584-3	0.015	41	34	118	96
UBI-2584-3	0.02	31	38	105	107
UBI-2051-1 + UBI-2383-1	1.04 + 0.15	44	37	111	92
UBI-2092-1 + UBI-2379	0.51 + 0.10	44	44	150	106
UBI-2092-1 + UBI-2454-1	0.51 + 0.06	36	38	112	91
TF-3716	1.02	44	36	126	105
TF-3716	1.30	39	43	137	105
ROVRAL	0.90	38	36	93	86
AGSCO DB-GREEN L	1.01 + 0.34*	36	44	102	106
SEM**		3.5		10.8	
LSD (P = 0.05)		10.1	NS	30.8	NS

* Maneb at 1.01 and lindane at 0.34 g ai/kg seed.

** SEM - Standard Error of Mean.

Table 2. Influence of seed treatments on barley leaf stripe (infected plants/row).

Treatment	Rate (g ai/kg seed)	Location Ottawa	Lacombe	Winnipeg	Charlottetown
Untreated	0.00	5.8	5.8	3.5	9.0
AGROX NM	1.30	0.0	0.0	0.0	0.3
UBI-2051-1	1.04	0.5	0.5	0.3	1.3
UBI-2092-1	0.51	0.3	2.3	2.5	3.3
UBI-2379	0.30	5.3	7.8	5.8	18.0
UBI-2383-1	0.15	0.0	0.0	0.5	0.3
UBI-2584-3	0.015	0.3	0.5	0.8	0.3
UBI-2584-3	0.02	0.5	0.5	0.3	0.0
UBI-2051-1 + UBI-2383-1	1.04 + 0.15	0.0	0.3	0.3	0.0
UBI-2092-1 + UBI-2379	0.51 + 0.1	1.8	2.0	4.8	4.8
UBI-2092-1 + UBI-2454-1	0.51 + 0.06	0.0	0.8	0.5	1.0
TF-3716	1.02	0.8	1.8	1.8	3.8
TF-3716	1.3	1.3	1.5	1.8	4.5
ROVRAL	0.9	0.0	0.3	0.3	0.5
AGSCO DB-GREEN L	1.01 + 0.34*	0.8	0.8	1.0	3.3
SEM**		0.91	0.59	0.67	0.85
LSD (P = 0.05)		2.60	1.68	1.91	2.42

* Maneb at 1.01 and lindane at 0.34 g ai/kg seed.

** SEM - Standard Error of Mean.

#134 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61006537

CROP: Barley, winter, various

PEST: Fusarium head blight, *Fusarium graminearum* Schwabe

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TITLE: SUSCEPTIBILITY OF WINTER BARLEY BREEDING LINES TO FUSARIUM HEAD BLIGHT IN ARTIFICIALLY INOCULATED AND MISTED PLOTS

METHODS: The crop was planted on 7 October, 1994 at Ridgetown using a 6-row cone seeder at 2,070 seeds per plot. Plots were six rows planted at a row spacing of 15 cm and 5 m in length placed in a randomized complete block design with four replications. One run of the planter had no emergence due to a plugged planter. Therefore two additional complete replications were planted on 13 October. The plots were fertilized and maintained using provincial recommendations. Inoculations were timed according to heading for each variety. The first inoculation was done when about 90% of the heads were emerged. Inoculations were repeated 1, 2, 4 and 7 d after heading. Heading occurred between 26 and 30 May. The plots were inoculated at around 4 pm with a 100 ml suspension of macroconidia of *F. Graminearum* at 1 X 10^5 spores/ml grown on liquid shake culture using modified Bilay's medium. Plots were misted daily beginning after the first plots were inoculated. The overhead mister operated at one 8 s burst every min for 2 h after 16:00 hr. The misters delivered about 7.5 mm of water each day. The mist system was engaged until 3 d after the last inoculation. Each variety was assessed for visual symptoms when the early dough stage was reached. Fifty heads were selected at random out of each plot. Heads were placed into one of eight classes 0, 5, 10, 15, 30, 50, 75, 100% infected spikelets. A Fusarium index was applied to the data, which was the product of the percent heads infected and the percent spikelets infected. The plots were harvested on 17 July. One hundred seeds were selected at random from each plot sample and the number of shrunken and discoloured seeds (tombstones) were counted. Sixty randomly-selected seeds were surface-sterilized in 3 % NaOCl for 90 s. These were plated on acidified potato dextrose agar and maintained at room temperature for 10 d, and the percent Fusarium infected kernels was determined. Deoxynivalenol content was estimated using solvent extraction (Acetonitrile: 4% KCl at 9:1), clean-up on an activated charcoal column and thin layer chromatography (Silca Gel HL plates, with chloroform:methanol (94:6) as the solvent system).

RESULTS: As presented in the table.

CONCLUSIONS: All the varieties tested were susceptible to fusarium head blight. Percent incidence and percent spikelets were related. Although more than 94 % of all the seeds were infected, seed infection was related to Fusarium index. There was no clear relationship between Fusarium index, and percent tombstone or deoxynivalenol content.

Table 1. Susceptibility of breeding lines of winter barley to fusarium head scab in artificially inoculated and misted plots. Ridgetown, Ontario. 1995

Winter barley line	Percent heads infected*	Percent spikelets infected	Fusarium index (PHI*PSI)	Percent tombstone	Percent seeds infected**	Deoxy-nivalenol (ppm)
H30-11	87 a-d***	23 bc	19 cd	47 abc	99 abc	9 ab
H30-52	92 abc	31 ab	29 abc	56 abc	100 a	9 ab
H31-59	94 ab	29 abc	27 a-d	47 abc	99 abc	21 a
H49-5	92 abc	29 abc	26 a-d	51 abc	98 a-d	14 ab
H54-28	85 bcd	25 abc	21 a-d	50 abc	96 cd	6 b
H59-4	94 ab	36 a	34 a	83 a	99 abc	17 ab
H58-4	94 ab	32 ab	30 abc	37 c	97 bcd	15 ab
H80-9	94 ab	36 a	33 ab	45 bc	98 abc	15 ab
J0 91/21-4	95 a	34 ab	32 abc	81 ab	100 ab	21 a
OAC ACTON	80 d	19 c	15 d	44 bc	94 d	12 ab
OAC ELMIRA	81 cd	25 abc	20 bcd	24 c	96 cd	21 a
CV (%)	10.2	17.9	21.0	37.4	6.00	70.0

* Based on seed plantings.

** Based on visual symptoms.

*** Means followed by same letter do not significantly differ (P = .05, Duncan's MRT).

#135 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. Morrison

PEST: Net blotch, *Pyrenophora teres*

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TITLE: THE EFFECTS OF DOUBLE APPLICATIONS OF FOLIAR FUNGICIDES ON NET BLOTCH IN BARLEY, 1995

MATERIALS: TILT (propiconazole 250 EC); BAYLETON 50WP (triadimefon, 50% WP); FOLICUR 144EC (hexaconazole 39.1%); FOLICUR 45DF (hexaconazole 45.6%)

METHODS: Barley plots were established on May 15, 1995, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide and 5 m long. Treatments were replicated four times in a randomized complete block design.

The fungicides listed above were applied at two different application schedules. A single application was made at Zadok's Growth Stage (ZGS) 30, with the double application made at ZGS 30 followed by a second application at ZGS 45. Application were made using a CO_2 backpack sprayer, applying water at a rate of 500 L ha^{-1}, at a pressure of 200 kPa. For the FOLICUR treatments, the surfactant AGRAL 90 was used at the recommended rate 1 L product ha^{-1}.

Net blotch symptoms were assessed twice during the season at ZGS 69 (July 20) and ZGS 87 (August 1). The penultimate and third leaves were rated on the first date while only the penultimate leaf was rated on the second date. In both instances disease severity was rated on 10 randomly selected tillers per plot using the Horsfall and Barratt Rating System. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine.

RESULTS: This study was initiated to determine the effect of the test products against scald (*Rhynchosporium secalis*), however weather conditions were such that no scald developed in the plots. Since scald usually starts early in the season the experimental design was to test an early application versus a double application, where early control could be maintained with a second application.

Net blotch was the only major foliar disease in the plots. Overall the most effective material was TILT followed very closely by FOLICUR. BAYLETON was ineffective at disease control or yield response. Early application of TILT and FOLICUR formulations were not significantly different ($P = 0.05$). FOLICUR 144EC as in a double application did not result in a significant increase over the single application. However a double application both TILT and FOLICUR 45DF were very effective at both disease control and yield benefit when compared to either the untreated control or single applications of the products. A maximum disease control of approximately 80% (08/01 rating) and a yield increase of 27.5% were obtained from the double application of TILT.

There were significant correlations ($P = 0.05$) between disease ratings and both yield ($R^2 = -0.664$ to -0.768) and thousand kernel weight ($R^2 = -0.728$ to -0.777). A correlation also existed between yield and thousand kernel weigh ($R^2 = 0.711$).

CONCLUSIONS: While the most effective disease control and yield response was obtained with the double applications of TILT and FOLICUR formulations, it is likely that it was only the latter application which actually had the beneficial effects. In general there was no effect from the early (ZGS 30) applications, except for the yield response from the single FOLICUR 144EC application. A further effort is required to determine whether or not these products actually are more efficacious with single late applications versus early or a combination of early and late applications.

The disease correlations indicate that at least a portion of the yield benefit from treatment was directly related to disease reduction.

Table 1. Influence of foliar treatments on net blotch and yield in Morrison barley.

			Net Blotch				
			07/20	08/01			
Treatment	Rate*	Timing*	2nd leaf (%)	2nd leaf (%)	3rd leaf (%)	Yield (kg/ha)	1000 kwt (g)
UNTREATED	0		8.4	48.0	76.8	3340	42.0
TILT	125	30	6.3	29.5	65.4	3537	44.5
TILT	125	30+45	1.5	1.9	13.5	4259	47.4
BAYLETON	250	30	6.6	41.6	72.5	3496	43.3
BAYLETON	250	30+45	6.4	41.9	76.0	3360	43.2
FOLICUR 144EC	125	30	5.7	33.9	70.7	3715	43.3
FOLICUR 144EC	125	30+45	2.2	16.8	25.4	3928	46.6
FOLICUR 45DF	125	30	5.4	24.5	70.0	3484	44.8
FOLICUR 45DF	125	30+45	3.6	24.1	39.4	3906	46.2
SEM***			0.736	7.36	6.77	113.6	0.669
LSD (P = 0.05)			2.15	21.48	19.76	331.6	1.95

* Rate - g a.i./ha, each application timing.
** Timing - Zadok's Growth Stage(s) at time of application.
*** SEM - Standard Error of Mean.

#136 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. Morrison

PEST: Net blotch, *Pyrenophora teres*

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TITLE: INFLUENCE OF FUNGICIDE SEED TREATMENTS ON DISEASE AND YIELD IN BARLEY, 1995

MATERIALS: VITAFLO 280 (UBI-2051-1 + carbathiin 14.9% + thiram 13.2%)
ANCHOR (UBI-2359 + carbathiin 66.7 g/L + thiram 66.7 g/L)
UBI-2383-1 (BAYTAN 30 + triadimenol 317 g/L)
AGSCO DB-GREEN L (maneb 323 g/L + lindane 108 g/L)
AGSCO A-4452 (fenbuconazole 49 g/L)
AGSCO A-4452 PLUS (fenbuconazole 49 g/L + lindane 108 g/L)
VITAFLO 250 (UBI-2092-1 + carbathiin 25.3%)
UBI-2379 (metalaxyl, 317 g/L)
TF-3770A (hexaconazole 5.0 g/L)
TF-3794 2ME (paclobutrazol 2.0 g/L)
UBI-2584-3 (tebuconazole 8.37 g/L)
UBI-2016-4 (VITAFLO DP + carbathiin 171 g/L + thiram 118 g/L + lindane 134 g/L)

METHODS: Certified barley seed, cv. Morrison, was treated with the fungicides listed above at the rates listed in the table, in a small batch seed treater. Barley plots were established on May 23, 1995, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide and 5 m long. Treatments were replicated four times in a randomized complete block design.

Emergence was determined from counts on 2 m of row/plot, on 06/16. At Zadok's Growth Stage (ZGS) 45, seedling blight, and foliar net blotch were determined on 1 m of plants. In both cases a 0-9 scale was used where 0 = no disease symptom and 9 = severe disease symptoms. At ZGS 84 foliar net blotch was again rated, on the penultimate and third leaves of 10 randomly selected tillers per plot using the Horsfall and Barratt Rating System. Yield and thousand kernel weight were determined from the harvest of nine centre rows, using a small plot combine.

RESULTS: There was no significant effect (P = 0.05) of any treatment on emergence (data not presented) or on severity of seedling blight. Early net blotch was significantly reduced with

VITAFLO 280, UBI-2383-1 (BAYTAN 30) and AGSCO DB-GREEN L. Compared to the untreated control only TF-3794 2ME had a significant impact on late season disease with a 60% increase in net blotch severity. While not significant the best late season disease control was from UBI-2383-1 (BAYTAN 30) and AGSCO DB-GREEN L treatments. There was a significant (P = 0.01) correlation between seedling blight and net blotch at ZGS 45. There was also a significant correlation between net blotch severity at ZGS 84 and yield. Use of UBI-2383-1 (BAYTAN 30) at the higher rates resulted in significantly better yield than the control, with a maximum increase of 12%. Paclobutrazol (TF-3794 2ME) had the effect of significantly increasing disease which resulted in a significant yield suppression of 11.4% compared to the untreated control.

CONCLUSIONS: The significant regression between net blotch ratings and yield indicates that treatments which affect disease severity will also impact upon yield. UBI-2383-1 (BAYTAN 30) was the most effective material relative to disease reduction and yield benefit followed by VITAFLO 280 treatments, AGSCO DB-GREEN L and TF-3770A (hexaconazole) at the highest rate. Given apparent rate effects with both UBI-2383-1 (BAYTAN 30) and TF-3770A the rates of these materials, particularly TF-3770A (hexaconazole) may be below optimum. Of interest was paclobutrazol which appeared to significantly stimulate disease expression resulting in a significant yield loss.

Table 1. Influence of seed treatments on net blotch and yield in Morrison barley.

Treatment	Rate*	Seedling Net Blight ZGS 45 (0-9)	Net Blotch ZGS 45 (0-9)	Net Blotch ZGS 84 2nd leaf (%)	Net Blotch ZGS 84 3rd leaf (%)	Yield (kg/ha)	1000 kwt (g)
UNTREATED	0	2.00	3.00	16.5	38.0	3399	38.42
VITAFLO 280	0.93	1.75	1.50	14.2	38.7	3507	41.20
ANCHOR	1.07	1.50	2.00	15.2	41.2	3338	39.85
UBI-2383-1	0.15	1.50	1.50	15.9	43.5	3589	40.87
UBI-2383-1	0.30	1.25	1.25	9.4	27.0	3688	42.08
UBI-2383-1	0.45	1.75	1.25	10.0	29.0	3808	40.98
DB-GREEN L	1.43	2.00	1.25	9.8	27.0	3555	40.52
A-4452	0.16	2.00	2.25	27.1	53.6	3373	39.88
A-4452 PLUS	0.63	1.50	2.75	15.2	35.5	3383	39.87
VITAFLO 250	0.51	2.50	2.75	17.2	46.6	3359	38.70
VITAFLO 280 + UBI-2383-1	0.93 0.15	1.50	1.25	19.1	41.2	3370	38.73
UBI-2379	0.10	2.50	3.50	27.2	52.9	3260	37.26
VITAFLO 250 + UBI-2379	0.51 0.10	2.75	3.25	22.3	55.5	3301	39.15
TF-3770A	0.015	1.50	2.00	20.5	46.4	3425	39.89
TF-3770A	0.03	1.50	2.00	14.7	39.0	3598	39.67
TF-3794 2ME	0.01	2.75	4.00	29.3	60.9	3013	38.10
UBI-2584-3	0.02	1.75	2.00	18.3	43.5	3332	39.66
UBI-2584-3	0.04	1.50	2.00	15.7	37.7	3644	40.99
UBI-2016-4	1.04	2.00	2.00	24.3	55.5	3533	40.93
SEM**		0.380	0.360	4.26	6.24	99.0	0.837
LSD (P = 0.05)		NS	1.02	12.1	17.7	281	2.37

* Rate - g a.i./kg seed.

** SEM - Standard Error of Mean.

#137 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. Morrison

PEST: Net blotch, *Pyrenophora teres*

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TITLE: YIELD RESPONSE IN BARLEY TO NET BLOTCH AS INFLUENCED BY FUNGICIDE SPRAYS, 1995

MATERIALS: TILT (propiconazole 250 EC); BAYLETON 50WP (triadimefon, 50% WP); FOLICUR 144EC (hexaconazole 39.1%); FOLICUR 45DF (hexaconazole, 45.6%)

METHODS: Barley plots were established on May 23, 1995, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide and 5 m long. Treatments were replicated four times in a randomized complete block design.

The fungicides listed above were applied at the rates listed in the table below, at Zadok's Growth Stage (ZGS) 45. Applications were made using a CO_2 backpack sprayer at a rate of 500 L H_2O ha^{-1}, at a pressure of 200 kPa. For the FOLICUR treatments, the surfactant AGRAL 90 was used at the recommended rate 1 L product ha^{-1}.

Net blotch symptoms were assessed at ZGS 83 (July 28). The penultimate and third leaves were rated on 10 randomly selected tillers per plot using the Horsfall and Barratt Rating System. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine.

RESULTS: Both disease ratings were significantly correlated ($P = 0.05$) with yield ($df = 22$, $R^2 = -0.703$ and -0.641) and thousand kernel weights ($R^2 = -0.504$ and -0.650) on the 2nd and 3rd leaves respectively. Thousand kernel weight was also significantly correlated with yield ($R^2 = 0.530$).

Of the test fungicides only BAYLETON failed to have a significant effect on yield. TILT provided the maximum yield benefit of 12.7% over the untreated control. The yields from both FOLICUR treatments were not significantly different from the TILT yield.

CONCLUSIONS: While there may have been no significant reduction in foliar disease from the treatments, they did effect disease levels which in turn impacted on yield. This was evident from the significant disease with yield correlations. TILT and FOLICUR treatment were the effective materials. BAYLETON at even double the application rates for TILT and FOLICUR had no effect on yield response to net blotch.

Table 1. Influence of single application of foliar fungicides on net blotch and yield in Morrison barley.

		Net Blotch ZGS 83			
Treatment	Rate*	2nd leaf (%)	3rd leaf (%)	Yield (kg/ha)	1000 kwt (g)
UNTREATED	0	20.8	74.2	3070	41.1
TILT	125	11.8	53.7	3460	42.0
BAYLETON	125	20.9	78.0	3060	39.7
BAYLETON	250	18.8	79.7	3050	40.7
FOLICUR 144EC	125	13.1	70.6	3410	41.0
FOLICUR 45DF	125	14.1	64.4	3390	42.3
SEM**		3.91	7.86	96.3	0.993
LSD (P = 0.05)		NS	NS	290	2.13

* Rate - g a.i./ha, each application timing.

** SEM - Standard Error of Mean.

#138 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1212-8907

CROP: Barley, various 6-row cultivars

PEST: Net blotch, *Pyrenophora teres*
Scald, *Rhyncosporium secalis*

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TITLE: THE EFFECTS OF TIMED FOLIAR APPLICATIONS OF TILT ON NET BLOTCH, SCALD AND YIELD IN 6-ROW BARLEY CULTIVARS, 1995

MATERIALS: TILT (propiconazole 250 EC)

METHODS: Barley plots were established on May 15, 1995, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide and 5 m long. Treatments were replicated four times in a randomized complete block design. TILT was applied at two different application schedules. A application was made either Zadok's Growth Stage (ZGS) 45-49 or when the severity of net blotch on the fourth leaf from the head was at 10%. Applications were made using a CO_2 backpack sprayer, at a rate of 500 L H_2O ha^{-1}, at 200 kPa.

Scald severity was assessed at ZGS 79 (July 25) on the third leaf from the head. Net blotch severity was assessed at ZGS 79 (July 24) on the penultimate and third leaves. In both cases disease severity was rated on 10 randomly selected tillers per plot using the Horsfall and Barratt Rating System. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine.

RESULTS: There was a significant correlation ($P = 0.01$) between yield and scald severity, however there was no correlation between net blotch severity and yield. With the exception of yield there were significant interactions between cultivar and foliar treatment

For OAC Kippen and Etienne neither TILT timing had a significant effect on net blotch severity. Of the remaining cultivars there was little difference between the application made when net blotch severity was at 10%, on the fourth leave from the head, compared to the growth stage timed application. Application at ZGS 45 was the best application on Chapais and Duke for net blotch control, and on Sabina and Maskot for scald control. Yield responses from both timings were significantly better than the check but the slightly better yield from the ZGS 45 application was not significantly better than the timed application based on disease severity.

CONCLUSIONS: The lack of a significant correlation between net blotch and yield, as has been reported in other trials where only one cultivar was used, was most likely due to variability in cultivar response to net blotch severity. The growth stage timed application appeared to be the preferable application in this trial, however it is recognized that the level of both net blotch and scald were very low. Since the spray scheduled on severity of disease in the plots was actual after the growth stage scheduled spray would indicate that a different level or leaf selection is required. There may be variation in the cultivar responses to TILT application however the low level of disease in this trial did not provide for the separation needed to determine cultivar yield responses.

Table 1. Influence of timed TILT applications on net blotch and scald in 6-row barley cultivars.

	Net Blotch (%)						Scald (%)		
	ZGS* 79, 2nd leaf			ZGS 79, 3rd leaf			ZGS 79, 3rd leaf		
Cultivar		Application Time			Application Time			Application Time	
	Un-treat	10%	ZGS45	Un-treat	10%	ZGS45	Un-treat	10%	ZGS45
Chapais	12.6	5.9	3.6	30.4	16.1	11.1	3.2	2.2	1.0
Duke	4.6	2.5	0.8	13.4	9.6	3.1	1.6	1.1	0.5
Etienne	2.2	1.4	1.1	6.9	5.2	3.2	4.6	1.3	0.7
Leger	5.0	1.5	1.9	15.6	4.4	4.0	2.1	0.9	0.9
Maskot	2.8	1.2	0.7	8.0	4.7	2.4	9.4	5.3	0.9
Sabina	2.5	1.1	0.2	7.7	3.6	1.7	11.0	10.9	3.2
OAC Kippen	1.5	1.4	0.2	4.4	4.6	2.3	2.6	0.6	0.2
AC Burman	4.3	2.3	1.7	12.4	5.8	3.9	2.0	0.9	0.5
AC Nadia	2.9	2.0	1.0	9.3	4.3	2.9	0.7	0.6	0.2
SEM**		0.79			1.95			1.10	
LSD (P = 0.05)		2.25			5.53			3.12	
Mean	4.3	2.1	1.2	12.0	6.5	3.8	4.1	2.7	0.8

* Zadok's Growth Stage at time of rating.

** SEM - Standard Error of Mean, for the interaction.

Table 2. Influence of timed TILT applications on yield and 1000 kernel weight in 6-row barley cultivars.

		1000 kwt (g)		
			Application Time	
Cultivar or Spray	Yield (kg/ha)	Un-treated	10%	ZGS45
Chapais	3720	44.44	43.82	45.42
Duke	3340	39.31	39.85	40.28
Etienne	3580	38.89	38.52	36.73
Leger	3700	34.68	35.53	36.01
Maskot	2820	35.02	36.58	36.72
Sabina	3060	33.84	35.84	36.68
OAC Kippen	3540	35.97	35.34	37.38
AC Burman	3740	34.65	35.48	35.35
AC Nadia	4110	35.47	35.37	35.88
SEM*	68.9		0.643**	
LSD (P = 0.05)	224		1.82	
Untreated	3419			
TILT 10%	3521			
TILT ZGS45	3594			
SEM*	31.1			
LSD (P = 0.05)	89			

* SEM - Standard Error of Mean.

** SEM and LSD for interaction.

#139 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1212-8907

CROP: Barley, various cultivars

PEST: Net blotch, *Pyrenophora teres*
Scald, *Rhyncosporium secalis*

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TITLE: THE EFFECTS OF TIMED FOLIAR APPLICATIONS OF TILT ON NET BLOTCH, SCALD AND YIELD IN TWO ROW BARLEY CULTIVARS, 1995

MATERIALS: TILT (propiconazole 250 EC)

METHODS: Barley plots were established on May 15, 1995, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide and 5 m long. Treatments were replicated four times in a randomized complete block design. TILT was applied at two different application schedules. A application was made at either Zadok's Growth Stage (ZGS) 45-49 or when the severity of net blotch on the fourth leaf from the head was at 10%. Applications were made using a CO_2 backpack sprayer, at a rate of 500 L H_2O ha^{-1}, at 200 kPa.

Scald severity was assessed at ZGS 79 (July 25) on the third leaf from the head. Net blotch severity was assessed at ZGS 57 (July 21) on the penultimate and third leaves. In both cases disease severity was rated on 10 randomly selected tillers per plot using the Horsfall and Barratt Rating System. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine.

RESULTS: There was a significant interaction between cultivars and spray schedule for net blotch and scald severity, however there were no interactions in yield or thousand kernel weights. While there was no correlation between scald severity and yield there was a significant correlation ($P = 0.01$) between net blotch severity ratings and yield.

Iona and AC Sterling did not respond to application of TILT on either leaf for net blotch control, regardless of the timing. There was variability between cultivars in net blotch response to the application schedule, however TILT applied at ZGS 45 appeared to be the preferable application timing for net blotch control. While scald severity was very low, a similar response was observed. The improved disease control was reflected in yield responses with TILT applied at ZGS 45 providing for a 10.3% and 5.1% increase in yield over the untreated plots and TILT 10%, applied according to disease level in the plots, respectively.

CONCLUSIONS: In two row barleys it was shown that TILT application timed according to growth stage was more effective than when timed according to a set disease level in the plots. It is recognized that there are cultivar differences in disease control, although these were not reflected in the positive yield responses.

Table 1. Influence of timed TILT applications on net blotch and scald in two row barley cultivars.

	Net Blotch (%)						Scald (%)		
	ZGS* 57, 2nd leaf			ZGS 57, 3rd leaf			ZGS 79, 3rd leaf		
Cultivar		Application Time			Application Time			Application Time	
	Un-treat	10%	ZGS45	Un-treat	10%	ZGS45	Un-treat	10%	ZGS45
Albany	5.7	2.1	0.9	19.6	6.6	3.3	7.3	1.0	0.3
Morrison	4.7	3.5	0.9	17.0	10.7	3.0	4.6	3.2	0.4
Helena	3.7	3.0	1.2	13.9	10.3	4.0	3.1	2.0	0.2
Iona	1.8	2.0	0.2	5.0	6.7	2.3	1.9	2.1	0.6
Micmac	5.0	3.5	0.9	16.9	15.4	3.2	4.6	2.9	0.4
Winthrop	11.3	7.6	2.0	31.9	22.7	5.3	2.9	1.7	1.1
Lester	4.1	3.0	1.7	16.5	10.0	4.6	2.2	2.1	0.6
AC Sterling	2.4	2.1	0.4	8.5	6.0	2.2	5.0	1.4	0.1
Wellington	3.2	1.8	1.3	12.6	6.6	4.9	5.4	0.4	0.6
Frin	7.6	5.2	2.5	22.7	17.7	5.7	2.8	2.6	0.4
SEM**	0.822			2.245			0.918		
LSD (P = 0.05)	2.32			6.35			2.60		
Mean	4.9	3.4	1.2	16.5	11.3	3.8	4.0	1.9	0.5

* Zadok's Growth Stage at time of rating.

** SEM - Standard Error of Mean, for the interaction.

Table 2. Influence of timed TILT applications on yield and 1000 kernel weight in two row barley cultivars (main effects).

Cultivar or Spray Timing	Yield (kg/ha)	1000 kwt (g)
Albany	3790	42.50
Morrison	3500	45.64
Helena	3560	42.46
Iona	3450	40.75
Micmac	3680	37.95
Winthrop	3220	38.50
Lester	3350	44.31
AC Sterling	3680	44.92
Wellington	3540	40.60
Frin	3380	42.17
SEM**	111.5	0.525
LSD (P = 0.05)	323	1.52
Untreated	3360	40.80
TILT 10%	3520	41.55
TILT ZGS45	3700	43.59
SEM**	36.0	0.223
LSD (P = 0.05)	102	0.63

* SEM - Standard Error of Mean.

#140 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 385-1212-9503

CROP: Barley

PEST: Scald, *Rhynchosporium secalis* (Oudem.) J.J. Davis

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TITLE: THE EFFECT OF SCALD INOCULUM AND TILT ON SIX BARLEY CULTIVARS, LACOMBE 1995

MATERIALS: TILT (250 g a.i./L propiconazole)

METHODS: AC Lacombe, Brier, Harrington, Jackson, Leduc and Manley were selected for their varying resistance to scald. Harrington, Jackson and Manley are rated susceptible, AC Lacombe and Brier rate intermediate, and Leduc rates resistant. (Varieties of Cereal and Oilseed Crops for Alberta - 1995. Agdex 100/32 Alberta Agriculture, Food and Rural Development). A split-split plot was set up with either artificial or natural inoculum as the main plot and the application of TILT as the sub-plot. The cultivars were randomized within each chemical treatment. Plots were seeded May 16 into barley silage stubble and were 4 rows 5.5 m long with 23 cm spacing between rows. Two rows of wheat were seeded between plots to limit disease spread. Straw infected with scald was chopped and applied to artificial plots on June 19. Scald inoculum for artificial plots was prepared by growing isolates of *R. secalis* on potato sucrose water at 17•C and 14 h daylight. After a 21 d incubation, a suspension of 10^4 spores/ml was prepared. TWEEN 20 was added as a surfactant. Spores were applied to run off using compressed air sprayers during the afternoon of June 20. TILT was applied at 125 g a.i./ha using a CO_2 back-pack sprayer on June 27. An early disease score was made June 28 using a 0-9 scale with 9 rating >50% disease on each of the lower, middle and upper leaf canopies. Prior to maturity, 20 flag and 20 penultimate leaves from each plot were collected and rated for percent leaf area diseased (PLAD). At maturity, plots were harvested and grain yields and 1000 kernel weights taken. Data was subjected to analysis of variance and treatment means were compared using least significant difference.

RESULTS: As presented in the table. Infection was very good and weather conditions were conducive to the spread of scald, resulting in no differences between natural or artificial inoculum for any data variable. There were significant cultivar differences for the early scald score ($LSD_{.05} = 0.3$) with Brier and Leduc scoring 1.4 and Jackson and Manley scoring 1.8. TILT application resulted in significantly lower PLAD for both the flag (2 vs. 9%) and the penultimate (4 vs. 26%) leaves. For both leaves, Jackson had significantly higher PLAD than the other cultivars. Harrington had the second highest PLAD scores, while Manley, the third susceptible cultivar, had the lowest PLAD scores of all the cultivars. There were significant interactions between cultivar and TILT application for both flag and penultimate PLAD, with Jackson PLAD being reduced by TILT from 27 to 4% (flag) and 60 to 5% (penultimate). The PLAD reduction for the other cultivars treated with TILT was not as extreme. The application of TILT significantly increased yield and 1000 kernel weight. As expected for this diverse material, there were significant cultivar differences for both yield and 1000 kernel weights.

CONCLUSIONS: There were no differences for any data variable for artificial or natural scald inoculation. TILT application significantly reduced PLAD for both the flag and penultimate leaves and increased yield and 1000 kernel weights. The magnitude of the differences was cultivar dependent. In this experiment, Manley which is rated susceptible, showed a relatively high early scald score and then the lowest PLAD for the flag and penultimate leaves. Jackson, also rated susceptible, had the same early scald score as Manley (1.8), and the highest PLAD scores. Further investigation is warranted to explain this discrepancy between official disease susceptibilities and field testing.

Table 1. The effect of artificial or natural scald inoculum and TILT on six barley cultivars, Lacombe 1994.*

Inoculum	Chemical	Cultivar	Jun 28 Scald Score**	Flag PLAD	Penu PLAD	Kg/ha	1000 Kernel Wt (g)
Artificial	No	AC Lacombe	1.2	3	13	5257	45.3
		Brier	1.5	5	23	4560	41.9
		Harrington	1.5	5	22	4296	47.9
		Jackson	2.0	22	54	3792	39.7
		Leduc	1.3	5	18	3903	43.5
		Manley	1.5	3	11	5042	49.8
	TILT	AC Lacombe	1.5	1	2	5613	46.3
		Brier	1.8	1	3	5190	44.5
		Harrington	1.0	2	5	4714	49.9
		Jackson	1.5	3	6	4687	40.9
		Leduc	1.2	2	5	4153	45.9
		Manley	2.0	1	2	5061	51.5
Natural	No	AC Lacombe	1.8	5	20	5392	44.0
		Brier	1.0	6	22	4965	43.2
		Harrington	1.8	5	22	4772	48.4
		Jackson	2.0	33	66	4056	39.4
		Leduc	1.5	6	20	4177	45.0
		Manley	1.7	5	18	5366	49.4
	TILT	AC Lacombe	2.0	2	3	5733	45.7
		Brier	1.5	1	2	5773	45.0
		Harrington	2.0	2	4	5205	49.7
		Jackson	1.8	5	9	4308	41.1
		Leduc	1.5	2	3	4799	46.0
		Manley	2.0	2	3	5846	51.4
LSD .05							
Chemical			ns	1.8	2.2	197	.4
Cultivar			.3	3.1	3.7	341	.7
Chemical x Cultivar			ns	4.3	5.3	ns	ns
Inoculum x Chemical x Cultivar			ns	ns	ns	ns	ns

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* Mean of four replications.

** 0-9 scale where 9 rates >50 PLAD on the upper, middle and lower leaf canopy.

#141 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1212-9301

CROP: Oat, cv. Capital

PEST: Speckled leaf blotch, *Septoria avenae*
Other naturally occurring seedling diseases

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TITLE: CONTROL OF OAT DISEASES WITH FUNGICIDE SEED TREATMENTS AND FOLIAR SPRAYS, 1995

MATERIALS: Seed treatments: VITAFLO 280 (carbathiin, 167 g ai/L + thiram, 148 ai/L); BAYTAN (triademinol, 317 g ai/L); AGSCO DB-GREEN (maneb 323 g ai/L + lindane 108 g ai/L); AGSCO A-4452 (fenbuconazole, 49 g ai/L); PP-333 (paclobutrazol, 2 g ai/L). Foliar sprays: TILT (propiconazole 250 EC); BAYLETON (triadimefon 50 WP), BRAVO (chlorothalonil 500 g ai/L); ICIA-5504 (azoxystrobin, 80%).

METHODS: Field plots were established on 17 May 1995 at the Harrington Research Farm, PEI, using separate blocks for each fungicide test. The seed treatments were applied to pedigreed seed at the rates listed in the table below using a rotary batch type laboratory treater. For the seed treatment trial plots were 6 rows wide by 5 m long separated by two guard rows of barley, and arranged in a randomized block with 4 replicates per treatment. The foliar spray plots were of a similar size but separated from adjacent plots by an additional barley plot of the same size. Standard production recommendations were used for tillage, fertilization and weed control. Foliar sprays were applied using a direct injection sprayer delivering 340L/ha water at 207 kPa pressure. Emergence was determined at Zadoks growth stage (ZGS) 10 and foliar disease severity on all plots at ZGS 72 using a 1-9 scale, where 1 was healthy and 9 a severity where the lamina of the top two leaves was 100 % lesioned. Harvest of the 6 centre rows was completed using a Hege small plot combine and data reported on a 86 % dry matter basis.

RESULTS: As presented in the tables.

CONCLUSIONS: Application of fungicides as either seed treatments or foliar sprays had little influence on disease severity or yield of Capital oats. Withe the exception of PP-333, seed treatments slightly reduced emergence but this was not reflected in changes in grain yield. TILT at the higher rate of foliar application significantly decreased severity of Septoria leaf lesioning but did not influence grain yield.

Table 1. Effect of fungicide seed treatments on emergence and disease severity of oats.

Treatment	Rate /kg seed*	Emergence plants/m^2	Leaf disease severity (1-9)	Yield (kg/ha)
UNTREATED	nil	443	4.0	4899
VITAFLO 280	3.3 ml pr	365	3.5	4303
BAYTAN	0.15 ai	340	3.0	4759
AGSCO DB-GREEN	3.31 ml pr	343	3.3	4558
AGSCO A-4452	3.31 ml pr	300	3.5	4712
AGSCO A-4452	4.04 ml pr	321	3.3	5044
PP-333	5.0 ml pr	432	4.0	4923
PP-333	10.0 ml pr	485	4.0	4886
CV		12.7	14.2	12.9
LSD (O.O5)		70.9	ns	ns

* pr = product/kg; ai = active ingredient.

Table 2. Efficacy of foliar applied fungicides on disease severity and yield of oats.

Treatment	Rate g ai/ha	Foliar disease severity (1-9)	Yield (kg/ha)
UNTREATED	Nil	4.5	4905
TILT	125	3.5	5097
TILT	250	2.8	4993
BRAVO	1000	4.5	5148
BRAVO	2000	4.1	4914
BRAVO + TILT	125+1000	4.4	4865
BRAVO + TILT	250+2000	4.6	4824
BAYLETON	125	4.0	5212
BAYLETON	250	4.0	4963
ICIA-5504	75	3.8	4980
ICIA-5504	125	4.0	5253
ICIA-5504	175	3.8	5053
ICIA-5504	225	4.6	4959
CV		14.3	5.2
LSD (0.05)		0.81	ns

#142 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1212-8907

CROP: Soybean, various cultivars

PEST: Various

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TITLE: THE EFFECTS OF FUNGICIDE SEED TREATMENT ON SOYBEAN CULTIVARS AT TWO LOCATIONS, 1995

MATERIALS: ANCHOR (carbathiin 66.7 g/L + thiram 66.7 g/L);
BAYTAN 30 (UBI-2383-1 + triadimenol 317 g/L)

METHODS: Seed of the cultivars indicated in the tables below was treated with the above seed treatments in a small batch seed treater, at 8 ml product kg^{-1} seed for ANCHOR and 2.5 ml product kg^{-1} seed for BAYTAN 30. In Prince Edward Island, soybean plots were established on May 26, 1995, at a seeding rate of 130 kg/ha, at the Harrington Research Farm. Each plot was 10 rows wide (1.8 m) x 6 m long. Treatments were replicated four times in a randomized complete block design. Emergence counts were taken on two complete rows per plot. When cotyledons were beginning to yellow and fall off, the degree of discolouration on the cotyledons was determined on a 0-9 basis, 0 low to 9 cotyledons fallen off or completely discoloured, on a whole plot basis. Plots were harvested on Oct 19th using a small plot combine.

In Hartland New Brunswick, plots were established on June 1, 1995 at 80 viable seeds/m2. Treatments were replicated four times in a randomized complete block design. Height to the first pod, and plant height were determined. Lodging was determined at harvest on a 0-9 scale, 0 being no lodging to 9 completely lodged. Plots were harvested on Oct 13th using a small plot combine.

RESULTS: There was a significant effect of fungicide application on emergence and cotyledon damage in PEI, with a significant effect on lodging in NB. There was no significant effect of fungicide treatment on yield. There were significant cultivar responses but no significant interactions between cultivar and fungicide treatment, with the exception of the cotyledon damage rating in PEI. Results for each location are presented in the table below. There was no significant effect on height to first pod and the data is not presented.

CONCLUSIONS: While there was no effect of fungicide treatment on yield there were two interesting effects which were significant. While plant height was not effected by treatment there was a significant increase in lodging as a result of BAYTAN 30 treatment. The reason behind this was not apparent, except that it was not related to height of the crop. The influence which BAYTAN 30 had on cotyledons may have been due to anti-senescence properties of the material or from providing protection against stress such as herbicide contact. The potential as a protecting agent against herbicide damage was evaluated in the greenhouse by applying Lorox to one of the cotyledons with no effect being demonstrated between the BAYTAN 30 treatment and the untreated control. Thus it would appear that, at least early in the season, there is a physiological effect on soybeans from BAYTAN 30, however this does not necessarily equate to a yield effect. The significant interaction with cotyledon damage appeared to be related to ANCHOR significantly increasing damage in some cultivars but not in others.

Table 1. Influence of fungicide seed treatments on soybeans, PEI, 1995.

Cultivar or Fungicide Treatment	Emergence (plants/ 2 rows)	Cotyledon Damage (0-9)				Yield
		Interaction				
		Untreated	ANCHOR	BAYTAN	Mean	(t/ha)
AC Proteus	143	5.5	7.3	0.3	4.3	2.0
Baron	127	7.8	7.5	0.8	5.3	2.0
OAC Vision	126	7.3	8.0	0.0	5.1	2.1
Maple Glen	120	3.0	6.0	1.3	3.4	2.2
S00-66	121	6.5	7.5	1.0	5.0	2.2
Brant	116	2.8	3.3	0.5	2.2	2.4
Bayfield	103	4.0	7.5	1.0	4.2	2.5
AC Hercule	130	4.3	6.5	0.5	3.8	2.1
SEM*	2.99		0.42**		0.24	0.05
LSD (P = 0.05)	8.5		1.17		0.68	0.14
Untreated	127				5.1	2.2
ANCHOR	124				6.7	2.1
BAYTAN 30	119				0.7	2.1
SEM*	1.83				0.15	0.03
LSD (P = 0.05)	5.2				0.42	NS

* SEM - Standard Error of Mean.

** SEM - Standard Error of Mean and LSD for the interaction.

Table 2. Influence of fungicide seed treatments on soybeans, NB, 1995.

Cultivar or Fungicide Treatment	Lodging (0-9)	Plant Height (cm)	Yield (t/ha)	Seed Weight (g/100 seeds)
AC Proteus	2.8	96.4	2.4	16.5
Baron	2.7	84.5	2.8	16.0
OAC Vision	1.3	84.3	2.8	17.8
Maple Glen	2.8	91.0	2.6	18.1
S00-66	2.2	93.6	2.8	17.1
Brant	3.8	94.0	2.5	19.2
AC Hercule	3.3	96.7	2.1	18.4
SEM*	0.45	1.05	0.077	0.265
LSD (P = 0.05)	1.27	2.96	0.22	0.75
Untreated	2.1	92.3	2.6	17.3
ANCHOR	2.5	90.8	2.6	17.8
BAYTAN 30	3.5	91.4	2.5	17.7
SEM*	0.30	0.685	0.051	0.173
LSD (P = 0.05)	0.85	NS	NS	NS

* SEM - Standard Error of Mean.

#143 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 375-1411-8719

CROP: Wheat, spring, cv. Leader
Barley, 6 row, cv. Brier

PEST: Common root rot, *Cochliobolus sativus*

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TITLE: EFFECT OF SEED TREATMENT FUNGICIDES ON EMERGENCE, COMMON ROOT ROT AND YIELD OF LEADER SPRING WHEAT AND BRIER BARLEY, 1995

MATERIALS: From Ciba-Geigy: Dividend (difenconazole 360 g/L); from Gustafson: UBI-2100-4 (carbathiin 230 g/L); UBI-2584-1 (tebuconazole 8 g/L);
from Zeneca: AGROX FLOWABLE (maneb 300g/L)

METHODS: The test was established at Saskatoon, Saskatchewan in 1995. Naturally occurring inoculum of *C. sativus* was relied upon for infection. Seed was treated in 1000 ml glass jars. Chemical treatments were dispersed over the glass surface, then for wheat 300g of seed was added and shaken, and for barley 350 g of seed was added and shaken. To ensure uniform coverage of the seed, the first treated lot of seed was discarded and a second lot was packaged for seeding. Seed was treated with Agrox Flowable and UBI-2100-4 on May 01, and using the same seed lot Ciba-Geigy and Gustafson provided treated seed. Wheat and barley were in separate tests. Each test was a randomized complete block design with six replicates. Plots had 4 rows; each row was 6 m long. Rows were 23 cm apart with 350 seeds planted in each row. Seeding and fertilizing (40 kg/ha with 11-55-0) took place May 17; emergence was recorded on June 01 on 2 m of one of the centre rows. Common root rot was recorded for barley, at early dough to ripening (D.R. Tottman and H. Broad. Ann. Appl. Biol. 10: 441-454, 1987) on August 16 by rating 40 plants randomly selected from one row. Common root rot on wheat was measured on August 16 at early to soft dough stage. Common root rot was determined by counting the number of plants with lesions covering greater than 50% of the subcrown internode for barley and 25% lesion coverage for wheat. Percent common root rot was calculated by multiplying the field score by 2.5. Harvesting (3 rows x 5 m long) of barley was done September 5 and wheat on September 8 with yield recorded as kg/ha of dry grain.

RESULTS: The results are summarized in the tables below.

CONCLUSIONS: For wheat, Dividend-1 (12g a.i.), 2 (24g a.i.) and 3 (40g a.i.), UBI-2100-4, and UBI-2584-1-1 (1 g a.i.) had higher yields than the control although not significant (P = 0.05) (Table 1). Disease rating was lower than the control for treatments Dividend-1 (12 g a.i.), 2 (24 g a.i.), and 3 (40 g a.i.) although not significant (P = 0.05). Emergence was significantly (P = 0.05) lower than the control for Dividend-2 (24 g a.i.), UBI-2584-1-1 (1 g a.i.) and 2 (2 g a.i.). Treatment with UBI-2584-1-2 (2 g a.i.) shortened and thickened subcrown internodes. For barley there was no significant difference from the control for yield (Table 2), although Agrox Flowable and UBI-2584-1-1 (1 g a.i.) had higher yields than the control. UBI-2584-1-2 (2 g a.i.) had a significantly (P = 0.05) lower disease rating than the control. There was no significant difference (P = 0.05) for emergence from the control for any treatment.

Table 1. The effect of seed treatment fungicides on emergence, common root rot and yield of Leader spring wheat.

PRODUCT	RATE (g a.i./kg seed)	EMERGENCE (plants/2m)	CRR (% disease)	YIELD (kg/ha)
Control	----	256a*	10abc*	2505a*
AGROX FLOWABLE	0.450	222ab	11ab	2501a
Dividend-1	0.120	229ab	6 bc	2607a
Dividend-2	0.240	205 b	5 c	2639a
Dividend-3	0.400	216ab	8abc	2628a
UBI-2100-4	0.550	223ab	13a	2579a
UBI-2584-1-1	0.010	204 b	13a	2564a
UBI-2584-1-2	0.020	192 b	10abc	2490a

* Values in the same column which are not followed by the same letter are significantly different at the 5% level of probability according to Duncan's Multiple Range Test.

Table 2. The effect of seed treatment fungicides on emergence, common root rot and yield of Brier 6 row spring barley.

PRODUCT	RATE (g a.i./kg seed)	EMERGENCE (plants/2m)	CRR (% disease)	YIELD (kg/ha)
Control	----	201a*	53ab*	3714ab*
AGROX FLOWABLE	0.450	229a	45 bc	4126a
UBI-2100-4	0.550	218a	63a	3587 b
UBI-2584-1-1	0.010	217a	56ab	4109a
UBI-2584-1-2	0.020	211a	38 c	3605 b

* Values in the same column which are not followed by the same letter are significantly different at the 5% level of probability according to Duncan's Multiple Range Test.

#144 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 375-1411-8719

CROP: Wheat, spring
Western Red Spring Wheat, cv. Katepwa
Canada Prairie Spring Wheat, cv. Biggar
Canadian Western Amber Durum, cv. Sceptre
Soft White Spring Wheat, cv. Fielder

PEST: Naturally occurring foliar diseases

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TITLE: EFFECT OF APPLICATION OF TILT ON FOLIAR DISEASE AND YIELD OF SEVERAL CLASSES OF SPRING WHEAT, 1995

MATERIALS: Ciba-Geigy: TILT (propiconazole 250g/L)

METHODS: The test was performed at the Agriculture and Agri-Food Research Centre farm located at Saskatoon. A split-plot design was used with cultivars as main plots and treatments as subplots. Each subplot was made up of eight rows. Four rows of winter wheat were planted between subplots. Seeding and seed placement with 50 kg/ha of 11-55-0 fertilizer took place on May 18 and 19. Treatments were sprayed using a hand-held, CO_2 pressurized, 4 nozzle boom sprayer (nozzle size 0.01) that delivered 225 L/ha at 240 kPa. The foliage of 8 rows was sprayed with Tilt at a rate of 125 g a.i./ha. Control subplots were sprayed with water on July 19. Spraying took place four times on July 7 (G.S. 45-49 boots swollen to first awns visible), July 12 (G.S. 58-65 three quarters of inflorescence emerged to anthesis one half way), July 19 (G.S. 67-71 anthesis half way to water ripe), and July 26 (G.S.71-83 water ripe to early dough) (D.R. Tottman and H. Broad. Ann. Appl. Biol. 10: 441-454, 1987). Ten penultimate leaves were collected on August 03 from randomly selected plants in the centre two rows of each subplot and were stored at 5• C until actual percent disease coverage was rated. Leaves from the control subplots were pressed and dried. They were scanned to determine the presence of obligate pathogens. Dried leaf pieces (4-6 cm) containing lesions were prepared and plated on water agar containing antibiotics. Sporulation was observed after about one week. Harvesting of 4 rows x 5m long occurred on September 8 with yield recorded as kg/ha.

RESULTS: Results are summarized in the table below. Cultivars were significantly ($P = 0.05$) different for yield with Fielder averaging 3835kg/ha, Biggar 3246, Katepwa 2971 and Sceptre 2740. The cultivar x treatment interaction was not significant for foliar disease or yield. Timing of spray application for July 19 was significantly ($P = 0.05$) lower than the control for yield.

Foliar disease was significantly (P = 0.05) reduced from the control by 30 percent for the July 12 spray date. Assessment of pathogens showed that in Sceptre, 47% of the leaf disease was caused by *Septoria tritici,* 44% by *Pyrenophora tritici-repentis* (tan spot) and 9% by *Septoria nodorum.* For Katepwa, 73% was caused by *S. tritici*, 17% by *S. nodorum*, and 10% by *P. tritici-repentis*. The major cause of leaf disease in Biggar was *S. tritici* at 56% while *P. tritici-repentis* caused 30% and *S. nodorum* caused 14%. In Fielder 68% of the leaf disease was caused by *S. tritici*, 27% by *P. tritici-repentis*, 3% by *Bipolaris sorokiniana* and 2% by *S. nodorum*.

CONCLUSIONS: The trial with Tilt significantly (P = 0.05) decreased foliar disease for one spray date, July 12. Yield was significantly decreased for the July 19 spray date.

Table 1. The effect of application of Tilt on foliar disease and yield on several classes of spring wheat.

SPRAY DATE	GROWTH STAGE	FOLIAR DISEASE (%)	YIELD (kg/ha)
Control		4.3a*	3284a*
July 7	43-47	3.9ab	3209a
July 12	58-65	3.0 b	3254a
July 19	67-71	4.3a	3002 b
July 26	71-83	4.4a	3274a

* Values for each variable in the same column which are not followed by the same letter are significantly different at the 5% level of probability according to Duncan's Multiple Range Test.

#145 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1212-9301

CROP: Wheat, spring, cv. Belvedere and Roblin

PEST: Powdery mildew, *Erysiphe graminis* f. sp. *tritici*
Leaf and glume blotch, *Septoria nodorum*
Naturally occurring seed and soil-borne pathogens

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TITLE: EFFECT OF FUNGICIDE SEED TREATMENTS AND FOLIAR SPRAYS ON DISEASE AND YIELD OF SPRING WHEATS, 1995

MATERIALS: Seed treatments: VITAFLO 280 (carbathiin 167 g ai/L + thiram 148 g ai/L); BAYTAN (triademenol 317 g ai/L); ASGRO DB (Maneb 323 g ai/L + lindane 108 g ai/L); ASGRO A-4452 (fenbuconazole 49 g ai/L);
PP-333 (paclobutrazol, 2 g ai/L). Foliar sprays: TILT (propiconazole 250 EC); BAYLETON (triadimefon 50 WP); BRAVO (chlorothalonil, 500 g ai/L);
ICIA-5504 (azoxystrobin, 80%).

METHODS: Field plots using the cultivars Belvedere and Roblin, were established at the Harrington Research Farm, PEI, on 17 May 1995 for foliar and seed applied fungicide trials, separate blocks for each study. Plots, 6 rows by 5 m, were established to give 4 replicates in a split block design with treatments as main plots and cultivars sub-plots. All plots were separated by 2 guard rows of barley in the seed treatment trial and by an additional 8 rows of barley in the foliar fungicide trial. Production recommendations for the region were followed for tillage, fertility and weed control procedures. Emergence in the seed treatment trial was determined by counting numbers of plants present in a 1 m section of the two centre rows from each plot at Zadoks Growth Stage (ZGS) 10. Sprays were applied using a direct injection sprayer delivering 340 L/ha water at 207 kPa pressure. Foliar disease severity was recorded on a 1-9 scale at ZGS 72 for each cultivar in both trials, 1 healthy to 9 severe disease. Yield was calculated on the harvest of the 6 centre rows from each sub-plot using a Hege 125 combine and reported on an 86% DM basis.

RESULTS: As presented in the tables.
Disease and yield of the two cultivars were significantly different from each other but both responded in a similar manner to treatments. VITAFLO 280 improved emergence of both cultivars and resulted in a significant yield increase of 6% with Belvedere. BAYTAN seed treatment increased emergence of Belvedere and reduced the mount of leaf disease on Roblin, a

cultivar very susceptible to powdery mildew, but did not result in a yield increase. AGSCO DB performed similar to VITAFLO 280 with improvements in emergence of both cultivars and a yield increase for Belvedere wheat only. AGSCO A-4452 application as a seed treatment increased the yield of Roblin slightly. PP-333 increased the emergence of Belvedere at both application rates but increased the yield only of Belvedere.

Application of foliar sprays did not result in reduction of foliar disease symptoms or increase yields. Maximum yield occurred with BRAVO (1000 g ai/ha) with an increase of 8% and 6%, respectively, over the untreated control.

CONCLUSIONS: The weather conditions in 1995 were conducive to the development of a normal amount of disease symptoms. Under these conditions, VITAFLO 280, BAYTAN, AGSCO DB and PP-333 illustrated increases in emergence of at least one cultivar. Foliar disease symptoms (primarily powdery mildew) was controlled by use of BAYTAN only on the susceptible cultivar Roblin. Yield increases were not associated with use of foliar fungicides in 1995.

Table 1. Effect of fungicide seed treatments on emergence, disease and yield of spring wheats.

Treatment	Rate /kg*	--Emergence-- Bel'vd**	Roblin	Leaf disease Bel'vd	Roblin	Yield (kg/ha) Bel'vd	Roblin
UNTREATED	Nil	312	347	6.3	8.0	3543	3025
VITAFLO 280	3.30 ml	410	397	6.5	7.5	3749	3039
BAYTAN	0.15 g	429	368	5.8	6.3	3570	3098
AGSCO DB	3.31 ml	402	402	5.8	7.6	3784	3190
AGSCO A-4452	3.31 ml	334	384	5.8	7.5	3563	3104
AGSCO A-4452	4.04 ml	322	337	6.3	8.0	3625	3275
PP-333	5.00 ml	413	370	6.4	7.6	3714	2979
PP-333	10.00 ml	371	386	5.8	7.3	3755	3123
CV		6.2		9.9		6.0	
LSD (0.05)		48.6		0.69		175.5	

* Rate, ml product or g ai/kg seed.

** Bel'vd - Belvedere.

Table 2. Efficacy of foliar applied fungicides on disease severity and yield of spring wheat.

Treatment	Rate	Foliar disease(1-9)		- Yield (Kg/ha) -	
	(g ai/kg)	Belvedere	Roblin	Belvedere	Roblin
Untreated	Nil	6.0	7.8	3556	2929
TILT	125	4.4	6.8	3594	2996
TILT	250	5.6	8.1	3734	2949
BRAVO	1000	4.0	7.0	3833	3116
BRAVO	2000	5.3	7.8	3678	3061
BRAVO + TILT	1000 + 125	4.9	7.0	3758	3047
BRAVO + TILT	2000 + 250	4.5	7.0	3821	3048
BAYLETON	125	5.4	7.0	3475	2905
BAYLETON	250	4.8	7.5	3396	2987
ICIA-5504	75	4.4	7.6	3639	2985
ICIA-5504	125	4.8	7.0	3681	2908
ICIA-5504	175	5.0	7.9	3782	3112
ICIA-5504	225	4.8	7.0	3621	2962
CV		11		6	
LSD (0.05)		ns		ns	

#146 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 1211-9501

CROP: Wheat, durum and common wheat

PEST: Tan spot, (*Pyrenophora tritici-repentis*)
Septoria leaf blotch, (*Leptosphaeria nodorum*)

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TITLE: EFFECT OF ETHEPHON AND PROPICONAZOLE ON DURUM AND COMMON WHEAT GROWN UNDER IRRIGATION IN 1991 AND 1992

MATERIALS: CERONE (ethephon); TILT (propiconazole)

METHODS: Ten durum and three common wheat genotypes were grown under overhead irrigation at Outlook, Saskatchewan, in 1991 and 1992. Plots were in a split-plot, with chemicals as main plots and genotypes as subplots. Subplots were nine 3 m rows. There were five treatments: untreated, growth regulator CERONE, (ethephon, 480 g/L, Hoechst) applied at a rate of 750 ml ha^{-1}, and three treatments of the fungicide TILT (propiconazole, 250 g L^{-1}, Ciba Geigy) applied to CERONE-treated plots. CERONE was applied when plants had swollen boots to 1/4 inflorescence emerged. TILT was sprayed at a rate of 700 ml ha^{-1} from swollen boots to before complete emergence of inflorescence, referred to as 'early', or at anthesis, referred to as 'late', or a double application both before complete emergence of inflorescence and anthesis, referred to as 'early,late'. Both chemicals were sprayed with a boom sprayer equipped with Tee Jet 8003 nozzles, using a boom pressure of 275 kPa. At medium milk to early dough stage, 10 penultimate leaves were taken at random from each of the plots, and the percent area of the leaves covered with leaf spots was recorded. Agronomic and quality data were also obtained. All data were analysed by GLM, and single degree of freedom contrasts among treatments were calculated.

RESULTS: Height and lodging in both 1991 and 1992, and maturity in 1991, were significantly affected by the use of CERONE alone. CERONE-treated plants were shorter, lodged less and took longer to mature than untreated ones (Table 1). Test weight in both years, and grain yield and 1000-kernel weight in 1991, were also significantly affected by the CERONE treatment. They were all higher in the CERONE-treated plots than in the untreated plots.

The severity of leaf spots (mainly tan spot and septoria leaf blotch) were affected by both the CERONE and TILT treatments in 1992, but only by TILT in 1991. In 1992, leaf spot severity in the plots treated with CERONE alone was higher than in the untreated plots. In both years, the TILT treatments reduced leaf spot severity in relation to the treatments that did not receive fungicide. The TILT treatment had a significant effect on protein in 1991, and on 1000-kernel weight in both years. TILT-treated plots had a higher protein concentration in 1991 than those treated with CERONE alone. The 'late' (1991), or 'late' and double (1992) TILT application resulted in higher 1000-kernel weight than the CERONE alone treatment. Grain yield in 1992 was also greater in the TILT-treated plots than in those that were not treated with the fungicide, although not significantly so. Few significant differences among the TILT treatments were observed. For example, the double application of TILT in 1991 was more effective than either of the single applications in increasing protein concentration.

CONCLUSION: The CERONE treatment increased grain yield and quality of durum and common wheat grown under irrigation, and appeared to have a greater effect in a dry (1991) than a wet (1992) year. Its use in 1992 also resulted in an increase in leaf spot severity. The increase in grain yield observed in the CERONE treatment appeared to be mostly related to an increase in 1000-kernel weight, and may be primarily due to a physiological response of the plants to the compound rather than to just a reduction in lodging. Delayed maturity might have played a role. TILT applied either before complete emergence of inflorescence or at anthesis, or at both times, was equally effective in reducing leaf spot severity in relation to both the CERONE alone, and control treatments. However, only kernel weight and protein were significantly, but not consistently, affected. Therefore, application of TILT to irrigated wheat treated with the growth regulator CERONE did not result in an improvement in yield or quality, even though it significantly reduced leaf area covered with leaf spots.

Table 1. Mean plant height, lodging score, time to maturity, grain yield, 1000-kernel weight, test weight, protein concentration and percent area covered with leaf spots of 13 wheat genotypes treated with CERONE and TILT, and grown under irrigation at Outlook, Saskatchewan.

Year/Treatment	Plant height	Lodging score	Time to maturity	Grain yield	1000-K weight	Test Weight	Protein	Leaf spots
	-cm-	0-9	-days-	-g-	-g-	-kg hL^{-1}-	-%-	-%-
1991								
Untreated	111.0	3.5	101.7	3338.4	45.0	80.7	14.3	5.8
CERONE©	106.5	2.0	102.6	3970.0	45.9	81.1	14.2	6.3
C + TILT(T)('early')*	106.0	1.8	101.9	3988.8	46.0	81.3	14.5	2.7
C + T ('late')	103.4	2.3	103.1	4014.8	46.6	81.3	14.5	3.7
C + T ('early,late')	103.1	1.9	103.3	4314.5	45.9	81.2	14.8	2.5
lsd (0.05)	0.8	0.4	0.8	525.2	0.7	0.2	0.2	1.2
1992								
Untreated	116.9	4.8	124.1	4778.6	44.6	77.2	14.0	14.1
CERONE ©	112.2	3.4	125.1	4811.4	45.4	77.8	13.9	22.2
C + TILT(T)('early')	114.1	3.6	126.6	5208.7	45.4	77.5	14.1	3.4
C + T ('late')	112.2	3.3	125.3	5274.6	46.8	78.3	14.0	6.8
C + T ('early,late')	111.2	3.8	128.4	5113.5	46.6	77.6	14.1	2.6
lsd (0.05)	3.7	0.6	1.5	510.3	1.3	0.5	0.3	5.5

* Tilt applied 'early' = from booting to before completion of inflorescence emergence, 'late' = at anthesis, 'early,late' = at both times.

#147 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61006537

CROP: Wheat, winter cv. unknown

PEST: Loose smut, *Ustilago tritici*

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TITLE: EFFECT OF SEED SIZE AND DILUTION OF SEED TREATMENT ON EFFECTIVENESS OF VITAFLO 280 TO CONTROL LOOSE SMUT IN WINTER WHEAT

MATERIALS: VITAFLO 280 (carbathiin + thiram, 167 and 148 g a.i./L)

METHODS: Seed known to be infected with loose smut was sorted according to two sizes (• and <0.25 cm in diameter for large and small seeds, respectively). The two lots of seed were treated separately on 29 September, 1994 in a mini rotostat seed treater in batches of 300 g. The crop was planted on 7 October, 1994 at Ridgetown using a 6-row cone seeder at 2,070 seeds per plot. Plots were six rows planted at a row spacing of 15 cm and 5 m in length placed in a randomized complete block design with four replications. The plots were fertilized and maintained according to provincial recommendations. The total number of heads showing smut infection were counted after anthesis (29 June, 1995) for each plot and then expressed as heads/m^2.

RESULTS: As presented in the table.

CONCLUSIONS: More smaller seeds were infected than larger seeds which emphasizes the fact that producers should use good quality seed. Control of loose smut with Vitaflo 280 did not differ between large and small seeds. The best control was achieved with the full un-diluted rate of Vitaflo 280. Reducing the rate of Vitaflo 280 by 33% and making up the difference with water, compromised the control of loose smut.

Table 1. Effect of seed size and dilution of Vitaflo 280 seed treatment on control of loose smut in winter wheat. Ridgetown, Ontario 1995.

Treatment	Rate (ml/kg seed)	No. smutted heads/m^2 29 June	Percent control
Large seeds			
1 NON-TREATED		42.5 c*	
2 VITAFLO 280	2.3	27.5 d	35
3 VITAFLO 280	3.3	12.5 e	71
4 VITAFLO 280 + WATER	2.3 + 1.0	25.8 d	39
Small seeds			
5 NON-TREATED		88.3 a	
6 VITAFLO 280	2.3	51.0 bc	42
7 VITAFLO 280	3.3	31.8 d	64
8 VITAFLO 280 + WATER	2.3 + 1.0	53.8 b	39
CV (%)		16.4	

* Means followed by same letter do not significantly differ (P = .05, Duncan's MRT).

NEMATODES / NÉMATODES

Section Editor / Réviseur de section : J.W. Potter

#148 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 335-1252-9405

CROP: Carrot

PEST: Northern root-knot nematode, *Meloidogyne hapla* Chitwood

NAME AND AGENCY:

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TITLE: EVALUATION OF CARROT CULTIVARS FOR TOLERANCE TO *MELOIDOGYNE HAPLA*, 1992

MATERIALS: Carrot cv. Apache, Carobrite, Goldpak 28, Navajo, Sixpak II

METHODS: The trial was conducted at the Agriculture and Agri-Food Canada Research Farm at Ste-Clotilde, Québec. Microplots (1 x 2 m) made of galvanized steel, were buried in a muck soil with a pH of 4.8-5.5 and over 80% organic matter. The soil inside was inoculated by incorporating soil naturally infested with *M. hapla*. Carrots were grown in these plots the year prior to the trial in order to increase nematode population densities. Based on their germination rates, the sowing density of the cultivars was adjusted to the 100 plants/m density. Inside each plot, carrot rows were 1 m in length and spaced 0.45 m apart. The treatments were arranged in a randomized complete block design with 10 replicates. On 28 September after 137 d of growth, carrots were harvested and graded for marketability, weighed, and rated on a root-gall index according to the following 0-5 scale: 0 = no galling, no forking, no stunting, marketable: 1 = 1-10 galls on secondary roots, taproot not affected, marketable; 2 = 11-50 galls, none coalesced, taproots with light forking, no stunting, unmarketable; 3 = 51-100 galls with some coalesced, forking, no stunting, unmarketable; 4 = more than 100 galls with some coalesced, severe forking and moderate stunting, unmarketable; 5 = more than 100 galls, mostly coalesced, severe stunting, unmarketable. Data were subjected to analysis of variance (ANOVA). Waller-Duncan k-ratio t test was used to compare treatments when ANOVA showed significant differences among means.

RESULTS: As presented in the table.

CONCLUSION: Early maturing carrot cultivars exhibited more tolerance to *M. hapla* induced damage than the late maturing ones. Gold Pak 28 and SixPak II were the most susceptible cultivars and Carobrite was intermediate. Because of this low level of tolerance, these cultivars cannot be economically grown in *M. hapla* infested soils.

Table 1. Effect of carrot cultivars on damage caused by *M. hapla* in organic soil, 1992.

Cultivars	Maturity	Marketable roots		Galling
		(%)	(t/ha)	(0-5)
Navajo	early	64.2 a	66.9 a	0.85 a
Apache	early	53.9 ab	60.5 ab	1.32 ab
Carobrite	mid-late	51.6 ab	51.8 b	1.41 ab
SixPak II	late	37.2 bc	27.3 c	1.88 bc
Gold Pak 28	late	29.4 c	19.0 c	2.21 c

* Values followed by the same letter are not significantly different (P = 0.05) according to Waller-Duncan k-ratio *t* test.

#149 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 335-1252-9405

CROP: Carrot

PEST: Northern root-knot nematode, *Meloidogyne hapla* Chitwood

NAME AND AGENCY:
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TITLE: EVALUATION OF LETTUCE FOR *M. HAPLA* MANAGEMENT AND IMPROVING CARROT YIELDS IN ORGANIC SOIL

MATERIALS: Carrot cv. SixPak II, Lettuce cv. Ithaca, Barley cv. Birka

METHODS: The trial was conducted at the Agriculture and Agri-Food Canada Research Farm at Ste-Clotilde, Québec. Microplots (1 x 2 m) made of galvanized steel, were buried in an organic soil with a pH of 4.8-5.5 and over 80% organic matter. The soil inside each microplot was inoculated by incorporating soil naturally infested with *M. hapla*. Carrots were grown the year prior to the trial in order to increase nematode population densities. Microplots were arranged in a randomized complete block design with six replicates. Crops included in the sequences were carrot cv. Sixpak II, lettuce cv. Ithaca and barley cv. Birka. In 1993, the following cropping sequences were performed: 1) a single crop of carrot (infested control); 2) a single crop of carrot (non-infested control); 3) an early season crop of lettuce (direct seeded) reaching maturity after 77 d followed by barley; 4) an early season crop of lettuce (transplant) reaching maturity after 55 d followed by barley; 5) two consecutive crops of lettuce (transplant) reaching maturity after 55 and 57 d. In 1994, all plots were planted to carrot. Inside each plot, carrots were grown in four rows, each 1 m long and spaced 0.45 m apart. At harvest, carrots were removed from the entire 4 m of row from each plot, graded for marketability, weighed, and rated on a root-gall index according to the following 0-5 scale: 0 = no galling, no forking, no stunting, marketable: 1 = 1-10 galls on secondary roots, taproot not affected, marketable; 2 = 10-50 galls, none coalesced, taproots with light forking, no stunting, unmarketable; 3 = 50-100 galls with some coalesced, forking, no stunting, unmarketable; 4 = more than 100 galls with some coalesced, severe forking and moderate stunting, unmarketable; 5 = more than 100 galls, mostly coalesced, severe stunting, unmarketable. Data were subjected to analysis of variance (ANOVA). Waller-Duncan k-ratio *t* test was used to compare treatments when ANOVA showed significant differences among means.

RESULTS: An early season crop of lettuce followed by barley reduced nematode populations and provided profitable carrot yield the subsequent year similar to the uninfested control. But the nematode root galling index indicated that carrot could not grown economically for a second year in these plots. No significant difference was detected between the direct seeded and transplant method in lettuce-barley sequences. Two crops of lettuce maintained high *M. hapla* population densities and provided unprofitable carrot yield the subsequent year. The lowest carrot yields were recorded in infested control plots.

CONCLUSION: Early season lettuce followed by barley reduced *M. hapla* population densities and improved carrot yields when compared to carrot monoculture. Even though the transplanted lettuce was harvested 22 d before the direct seeded lettuce, no significant improvement in carrot yield was detectable from this practice. Mid and late season lettuce increased *M.hapla* population densities beyond the economic threshold level for carrot production in organic soil.

Table 1. Carrot yields and *M. hapla* galling index on the last year of a 2-year cropping sequence in organic soil.

Treatment	Marketable roots (%)	Marketable roots (t/ha)	Galling (0-5)
Control (carrot, non-infested)	92.4 a	30.8 a	0.0 d
Early lettuce-barley (direct seeded)	72.8 b	28.2 a	0.6 c
Early lettuce-barley (transplants)	79.1 ab	31.0 a	0.5 c
Early lettuce-late lettuce (transplants)	35.6 c	11.3 b	2.1 b
Control (carrot, infested)	16.6 d	3.3 c	3.7 a

* Values followed by the same letter are not significantly different (P = 0.05) according to Waller-Duncan k-ratio t test.

#150 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 335-1252-9405

CROP: Carrot

PEST: Northern root-knot nematode, *Meloidogyne hapla* Chitwood

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TITLE: FALL PLOWING FOR NEMATODE CONTROL AND IMPROVING CARROT YIELD IN ORGANIC SOIL, 1994

MATERIALS: Carrot cv. SixPak II, Onion cv. Flame

METHODS: The trial was conducted at the Agriculture and Agri-Food Canada Research Farm at Ste-Clotilde, Québec in organic soil. In a *M. hapla* infested field, carrot cv. SixPak II and onion cv. Flame were each grown in a total of 6 plots (10 x 5 m each) arranged in a randomized complete block design. Carrots and onions were harvested and in early November, half of each plot was plowed at the 25 cm depth. In 1994, carrots cv. SixPak II were grown in all plots. At harvest, carrots were graded for marketability, weighed, and rated on a root-gall index according to the following 0-5 scale: 0 = no galling, no forking, no stunting, marketable: 1 = 1-10 galls on secondary roots, taproot not affected, marketable; 2 = 10-50 galls, none coalesced, taproots with light forking, no stunting, unmarketable; 3 = 50-100 galls with some coalesced, forking, no stunting, unmarketable; 4 = more than 100 galls with some coalesced, severe forking and moderate stunting, unmarketable; 5 = more than 100 galls, mostly coalesced, severe stunting, unmarketable.

Data were subjected to analysis of variance (ANOVA). Waller-Duncan k-ratio t test was used to compare treatments when ANOVA showed significant differences among means.

RESULTS: As presented in the table.

CONCLUSION: In 1993, a fall plowing in both onion and carrot plots has modified the soil temperature profile in organic soil (data not shown). Based on the carrot yield the subsequent year, a significant increase in marketable root was detected from plowed compared to the unplowed onion plots. This increase, and the reduction in gall index, suggest that the *M. hapla* mortality rates could have been increased by the practice of late-fall plowing after onion cropping. This same effect was not been detected in plowed carrot plots.

Table 1. Effect of fall plowing on carrot yields and *M. hapla* galling index in organic soil, 1994

Treatment	Marketable roots (%)	Marketable roots (t/ha)	Galling (0-5)
Onion - plow	46.9 a	33.3 a	2.3 b
Onion - no-plow	26.1 b	17.9 b	2.8 ab
Carrot - no-plow	24.3 b	14.0 b	2.9 ab
Carrot - plow	23.0 b	13.8 b	3.1 a

* Values followed by the same letter are not significantly different (P = 0.05) according to Waller-Duncan k-ratio *t* test.

PLANT PATHOLOGY / PHYTOPATHOLOGIE

ORNAMENTALS AND GREENHOUSE / PLANTES ORNEMENTALES ET DE SERRE

Section Editor / Réviseur de section : G. Platford

#151 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 390 1252 9201

CROP: Cucumber, greenhouse, cv. Corona

PEST: Gummy stem blight, *Didymella bryoniae* (Auersw.)Rehm

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TITLE: EFFICACY OF NOVA AGAINST GUMMY STEM BLIGHT ON GREENHOUSE CUCUMBERS

MATERIALS: NOVA 40WP (myclobutanil)

METHODS: Two trials were conducted at AAFC, PARC (Agassiz) for the control of gummy stem blight on greenhouse cucumbers. Each treatment unit consisted of one Corona cucumber plant growing in a 1 gallon pot filled with hemlock fir sawdust. The initial trial was seeded April 26, 1995. Each treatment was replicated 10 times. On June 7, 1995 each plant had the second leaf from the base removed and gummy stem blight inoculum (300,000 spores/plant) applied to the freshly cut surface. To encourage the development of gummy stem blight, after inoculation the plants were placed on plastic lined greenhouse benches in 3 cm of water and woven polypropylene shade fabric was placed around the bench to increase the relative humidity. Four treatment spray rates of myclobutanil were applied June 6, 1995 (pre-inoculation) and four treatment spray rates were applied June 12, 1995 (post-inoculation). Gummy stem blight evaluations were made on June 26, 1995. Gummy stem blight had developed when the post-inoculation treatments were applied. The second trial was seeded July 14, 1995. On August 23, 1995 plants were inoculated as in the first trial except the rate was 66,000 spores/plant. Two treatment spray rates of myclobutanil were applied August 22, 1995 (preinoculation) and three treatment spray rates were applied August 26,1995 (post-inoculation). Five replications of each treatment were evaluated for disease severity on September 5, 1995 and five replications were sprayed again and evaluated on September 19, 1995. The disease severity scale ranged from 10 for a fully developed lesion and 0 for the absence of gummy stem blight development. Data were statistically analysed.

RESULTS: NOVA reduced the development of gummy stem blight.

CONCLUSIONS: NOVA is effective in reducing gummy stem blight in greenhouse cucumbers. Post-inoculation treatments are more effective than preinoculation treatments. There was also a rate effect and gummy stem blight control tended to improve as the rate was increased.

Table 1. Mean gummy stem blight rating per cucumber plant.

Treatment	Rate ai/ha	gummy stem blight rating*
Control + inoculation	---	10.0a
NOVA + inoculation	37.5g	8.3ab
NOVA + inoculation	75.0g	7.6b
NOVA + inoculation	100.0g	8.1ab
NOVA + inoculation	135.0g	5.3cd
Inoculation + NOVA	37.5g	7.8b
Inoculation + NOVA	75.0g	6.8bc
Inoculation + NOVA	100.0g	4.8de
Inoculation + NOVA	135.0g	3.1e

* Means calculated from 10 replications. Numbers in column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 2. Mean gummy stem blight rating per cucumber plant

Treatment	Rate ai/ha	gummy stem blight rating*
Control + inoculaton	---	10.0a
NOVA + inoculation	100.0g	7.4b
NOVA + inoculation	135.0g	6.4bc
Inoculation + NOVA	75.0g	1.6e
Inoculation + NOVA	100.0g	1.4e
Inoculation + NOVA	135.0g	1.2e
NOVA + inoculation + NOVA	100.0g + 100.0g	5.0c
NOVA + inoculation + NOVA	135.0g + 135.0g	4.2cd
Inoculation + NOVA + NOVA	75.0g + 75.0g	2.6de
Inoculation + NOVA + NOVA	100.0g + 100.0g	0.4e
Inoculation + NOVA + NOVA	135.0g + 135.0g	0.6e

* Means calculated from 5 replications. Numbers in column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

#152 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 390 1252 9201

CROP: Cucumber, greenhouse, cv. Corona

PEST: Powdery mildew, *Sphaerotheca fuliginea*

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TITLE: EFFICACY OF NOVA AGAINST POWDERY MILDEW ON GREENHOUSE CUCUMBERS

MATERIALS: NOVA 40WP (myclobutanil)

METHODS: Two trials were conducted on greenhouse cucumbers for the control of powdery mildew in the greenhouse at AAFC, PARC(Agassiz). Treatments were replicated 10 times in both trials. Each treatment unit consisted of one Corona cucumber plant growing in a fifteen cm pot filled with hemlock fir sawdust. The initial trial was seeded on January 24, 1995. Treatments were applied February 21, 1995 and powdery mildew inoculum (equivalent to 800 colonies per leaf) was applied February 22, 1995. Myclobutanil was applied at 2000 g ai/ha and 100 g ai/ha. The high rate was used because silica makes up 60% of NOVA. Silica is known to reduce powdery mildew and this high rate matches the silica rate that would be used if silica was used alone. Powdery mildew colony counts were taken on March 6, 1995. The second trial was seeded on February 23, 1995 and plants were inoculated with powdery mildew on March 22, 1995. Two myclobutanil treatments were applied March 21, 1995 (pre-inoculation) and the other treatments were applied March 30, 1995 (post-inoculation). Powdery mildew had developed when the post-inoculation treatments were applied. Powdery mildew colonies were counted on April 5, 1995. The counts were statistically analysed.

RESULTS: All fungicide treatments reduced the number of powdery mildew colonies compared to the control.

CONCLUSIONS: NOVA is effective as both a preinoculation and post-inoculation treatment for the reduction of powdery mildew on greenhouse cucumbers.

Table 1. Mean powdery mildew counts per cucumber leaf.

Treatment	Rate ai/ha	Powdery mildew colonies/leaf*
Control + inoculation	---	183.5a
NOVA + inoculation	2000g	0 b
NOVA + inoculation	100g	0 b

* Means calculated from 10 replications. Numbers in each column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 2. Mean powdery mildew counts per cucumber leaf.

Treatment	Rate ai/ha	Powdery mildew colonies/leaf*
Control + inoculation	---	51.0a
Inoculation + NOVA	37.5g	1.6b
Inoculation + NOVA	75.0g	7.8b
Inoculation + NOVA	100.0g	2.4b
Inoculation + NOVA	135.0g	0.0b
NOVA + inoculation	37.5g	0.0b
NOVA + inoculation	75.0g	0.0b

* Means calculated from 10 replications. Numbers in each column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

#153 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Turf, Creeping Bentgrass

PEST: Pink snow mold, *Microdochium nivale*

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TITLE: HWG-1608 FOR CONTROL OF SNOW MOLD ON TURF

MATERIALS: HWG-1608 45 DF; ROVRAL GREEN (iprodione 250 g/L)

METHODS: A two year old sward of creeping bentgrass in Barrie Ontario was used as the trial site. Cultural practices were similar to those used to maintain golf course fairways. Treatments were applied on 04-Dec-94 to 1 x 2 m plots, replicated 4 times and arranged according to a randomized complete block design. A hand-held, CO_2 powered spray boom was used to apply all treatments. The boom was equipped with TJ 11003 flat fan nozzles, delivering a water volume of 500 L/ha at 220 kPa pressure. The area covered by disease was assessed visually in percent on 16-Mar-95. Data were analysed using analysis of variance and Duncan's Multiple Range Test at the 5% significance level.

RESULTS: Efficacy data are presented in the table below. There was no visual injury to the turf caused by any of the treatments tested.
CONCLUSIONS: All treatments provided effective control of pink snow mold without causing any phytotoxicity to the turf.

Table 1. Percent pink snow mold in plots treated with HWG-1608 45 DF.

Treatment	Formulation	Rate (g ai/100m^2)	% Disease 16-March-95
1. HWG-1608	45 DF	7.5	0.3 b
2. HWG-1608	45 DF	15	0.3 b
3 ROVRAL GREEN	250 F	84	0 b
4 UNTREATED	-----	----	19 a

* Means followed by the same letter are not significantly different (P = 0.05, Duncan's MRT).

#154 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Turf, Creeping Bentgrass

PEST: Pink snow mold, *Microdochium nivale*

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TITLE: DACONIL ULTREX ALONE AND IN COMBINATION WITH FLUAZINAM, ROVRAL GREEN, BANNER AND PCNB FOR CONTROL OF SNOW MOLD ON TURF

MATERIALS: ASC-67098-Z; BANNER 130 EC (propiconazole 130 g/L); DACONIL ULTREX (chlorothalonil 82.5%); ROVRAL GREEN (iprodione 250 g/L), FLUAZINAM 500F; PCNB 75 WP (quintozene 75%)

METHODS: A two year old sward of creeping bentgrass in Barrie Ontario was used as the trial site. Cultural practices were similar to those used to maintain golf course fairways. Treatments were applied on 04-Dec-94 to 1 x 2 m plots, replicated 4 times and arranged according to a randomized complete block design. A hand-held, CO_2 powered spray boom was used to apply all treatments. The boom was equipped with TJ 11003 flat fan nozzles, delivering a water volume of 500 L/ha at 220 kPa pressure. The area covered by disease was assessed visually in percent on 16-Mar-95. Data were analysed using analysis of variance and Duncan's Multiple Range Test at the 5% significance level.

RESULTS: Efficacy data are presented in the table below. There was no visual injury to the turf caused by any of the treatments tested.

CONCLUSIONS: All treatments provided effective control of pink snow mold without causing any phytotoxicity to the turf.

Table 1. Percent pink snow mold in plots treated with various fungicides.

Treatment	Formulation	Rate (g ai/100m^2)	% Disease 16-March-95
1. DACONIL ULTREX +	82.5 WG	120	0 b
Fluazinam	500 F	30	
2. DACONIL ULTREX +	82.5 WG	120	0 b
ROVRAL GREEN	250 F	28	
3. DACONIL ULTREX +	82.5 WG	120	0.3 b
BANNER	130 EC	16.1	
4. DACONIL ULTREX +	82.5 WG	120	0.3 b
BANNER	130 EC	24.2	
5 DACONIL ULTREX	82.5 WG	240	0.3 b
6 BANNER	130 EC	24.2	
7 DACONIL ULTREX +	82.5 WG	120	0 b
PCNB	75 WP	119.4	
8 PCNB	75 WP	238.7	0.3 b
9 ASC-67098-Z		143	0.3 b
10 Fluazinam	500 F	45	0 b
11 ROVRAL GREEN	250 F	84	0 b
12 UNTREATED	----	----	19 a

* Means followed by the same letter are not significantly different (P = 0.05, Duncan's MRT).

#155 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 93000480

CROP: Turfgrass, Kentucky bluegrass, *Poa pratensis* L., cvs. Nugget, Able 1 and Marquis

PEST: Powdery mildew, *Erysiphe graminis* DC.
Rust, *Puccinia brachypodii* G. Otth var. *poae-nemoralis* (G. Otth) Cummins & H.C. Greene

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TITLE: EFFICACY OF FOUR FUNGICIDES AGAINST POWDERY MILDEW AND RUST IN KENTUCKY BLUEGRASS SEED FIELDS IN SOUTHERN ALBERTA IN 1995

MATERIALS: LIME SULPHUR SOLUTION (sulphide sulphur 22% SN); DITHANE DG (mancozeb 75% WG); TILT 250E (propiconazole 250 g/L EC); NOVA 40W (myclobutanil 40% WP); COMPANION AGRICULTURAL ADJUVANT (octylphenoxypolyethoxy-(9)-ethanol 70% SN)

METHODS: Fungicide efficacy trials were conducted in three commercial bluegrass seed fields near Hays, Taber and Bow Island, Alberta. A fourth trial was conducted in a field near Rosemary, but the data were not included in this report because extremely low levels of mildew and rust precluded a meaningful test. Each treatment (see Tables 1-3) was applied to four, 10 m^2 subplots. A similar set of subplots was sprayed with tapwater as an untreated check. The non-ionic adjuvant COMPANION was added to the spray mixes containing NOVA 40W and DITHANE DG at the rate of 1.0 ml/L of mixture. The treatments were arranged in a randomized complete block design with four replications. The sprays were applied with a CO_2-propelled, hand-held boom sprayer equipped with four, Tee Jet 8002 nozzles. The spray was directed over the top of the plant canopy. The grass was 15-20 cm tall and not yet headed out on May 10-26 when all of the treatments designated as "Early (E)" (nos. 1, 3, 4, 6, 8 and 9), as well as the check, were sprayed for the first time. The equivalent of 200 L/ha of spray mixture was applied to each subplot using a boom pressure of 275 kPa. A moderate amount of mildew was present in the Bow Island and Taber plots at the time of spraying, but none was evident at Hays, and no rust was seen at any of the locations. From June 5-12, a second round of spraying for the "Late (L)" treatments (nos. 2, 3, 5, 6, 7, 8 and 9) was done when approximately 70-100% of the plants were in head. Mildew was showing on the lower leaves and stems, especially at Bow Island and Taber; no rust was observed at any of the three test sites. From July 10-18, random samples of 100 leaves were collected from each subplot at all locations and visually rated for mildew and rust incidence (% leaves affected) and severity (% leaf area diseased), i.e. clean (0) = no mildew/rust; slight (1) = 1-5%, moderate (2) = 6-25%, and severe (3) = >25%. When the grass stands were mature, 200 heads per subplot were harvested at each site and dried, threshed, cleaned and weighed to obtain seed yields. Disease incidence and severity data and seed weights were subjected to analysis of variance (ANOVA). Disease incidence figures were arcsin-transformed prior to ANOVA.

RESULTS: As presented in the tables.
Hays - Mildew and rust incidence and severity across the plot were low and highly variable and, as a result, no significant differences were noted between the various treatments (Table 1).
Taber - Mildew levels were moderately high and rust levels were low in this trial (Table 2). TILT (E/L) and NOVA (E/L) were the only treatments to have significantly lower mildew incidence and severity compared to the check. None of the fungicides significantly reduced rust levels or increased seed yields relative to the check.
Bow Island - Levels of mildew and rust at this site were generally low and none of the fungicides significantly reduced disease incidence or severity or increased seed yields relative to the check (Table 3).

CONCLUSIONS: Overall, the levels of powdery mildew and rust at the three sites were relatively low and non-uniform over the respective plot areas. However, TILT (E/L) and NOVA (E/L) generally provided the best control of powdery mildew as reflected by low incidence and severity ratings. Furthermore, the results suggested that for the most effective control of powdery mildew and rust, it may be necessary to apply at least two fungicide sprays, one in May and another in June.

Table 1. Incidence and severity of powdery mildew and rust on Nugget bluegrass treated with four fungicides in field plots at Hays, Alberta, in 1995.*

Treatment	Rate (product/ ha)	Incidence (%)**		Severity (0-3)		Seed yield (g/200 heads)
		Mildew	Rust	Mildew	Rust	
1. TILT 250E (Early=E)	0.5 L	3.8	3.5	0.04	0.04	9.0
2. TILT 250E (Late=L)	0.5 L	1.0	1.8	0.01	0.03	7.3
3. TILT 250E (E/L)	0.5 L	3.0	1.3	0.03	0.02	7.2
4. NOVA 40W (E)	0.25 kg	0.5	3.0	0.01	0.03	7.5
5. NOVA 40W (L)	0.25 kg	0.0	2.5	0.02	0.03	6.8
6. NOVA 40W (E/L)	0.25 kg	2.3	1.0	0.02	0.01	8.0
7. DITHANE DG (L)	2.25 kg	0.5	0.8	0.01	0.01	7.8
8. LIME S.+TILT (E/L)	9.4 L+0.5 L	0.5	0.0	0.01	0.00	9.0
9. LIME S.+NOVA (E/L)	9.4 L+0.25 kg	1.5	1.3	0.02	0.01	8.8
10. Untreated check	- -	1.8	2.0	0.02	0.02	7.6
ANOVA P• 0.05		ns	ns	ns	ns	ns
Coefficient of Variation (%)		154.7	150.4	149.5	142.9	18.1

* The values in this table are means of four replications.

** Disease incidence data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

Table 2. Incidence and severity of powdery mildew and rust on Marquis bluegrass treated with four fungicides in field plots at Taber, Alberta, in 1995.*

Treatment	Rate (product/ ha)	Incidence (%)**		Severity (0-3)		Seed yield (g/200 heads)
		Mildew	Rust	Mildew	Rust	
1. TILT 250E (Early=E)	0.5 L	64.8 ab	9.1	1.0 ab	0.11 ab	14.4
2. TILT 250E (Late=L)	0.5 L	30.3 bc	5.3	0.4 cd	0.09 ab	13.0
3. TILT 250E (E/L)	0.5 L	8.2 c	7.6	0.1 d	0.08 ab	14.0
4. NOVA 40W (E)	0.25 kg	46.0 abc	3.1	0.7 abcd	0.07 ab	14.3
5. NOVA 40W (L)	0.25 kg	23.6 bc	11.8	0.4 cd	0.13 ab	12.0
6. NOVA 40W (E/L)	0.25 kg	11.5 c	7.8	0.1 d	0.09 ab	12.9
7. DITHANE DG (L)	2.25 kg	77.3 a	13.8	1.1 a	0.18 a	14.4
8. LIME S.+TILT (E/L)	9.4 L+0.5 L	32.8 bc	5.8	0.4 cd	0.06 b	13.2
9. LIME S.+NOVA (E/L)	9.4 L+0.25 kg	42.9 abc	6.6	0.5 bcd	0.08 ab	13.7
10. Untreated check	- -	65.1 ab	8.5	0.9 abc	0.12 ab	12.2
ANOVA P• 0.05		s	ns	s	s	ns
Coefficient of Variation (%)		41.8	44.9	61.6	66.7	15.4

* The values in this table are means of four replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

** Disease incidence data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

Table 3. Incidence and severity of powdery mildew and rust on Able 1 bluegrass treated with four fungicides in field plots at Bow Island, Alberta, in 1995.*

Treatment	Rate (product/ ha)	Incidence (%)**		Severity (0-3)		Seed yield (g/200 heads)
		Mildew	Rust	Mildew	Rust	
1. TILT 250E (Early=E)	0.5 L	13.8 ab	8.5	0.21	0.10	9.7
2. TILT 250E (Late=L)	0.5 L	16.5 a	5.3	0.22	0.06	7.2
3. TILT 250E(E/L)	0.5 L	0.1 b	2.6	0.01	0.04	8.6
4. NOVA 40W (E)	0.25 kg	2.1 ab	6.5	0.05	0.08	10.0
5. NOVA 40W (L)	0.25 kg	0.4 b	2.0	0.01	0.03	8.9
6. NOVA 40W (E/L)	0.25 kg	0.3 b	1.5	0.01	0.02	9.8
7. DITHANE DG (L)	2.25 kg	16.5 a	7.1	0.22	0.07	8.9
8. LIME S.+TILT (E/L)	9.4 L+0.5 L	0.8 ab	2.6	0.02	0.03	9.2
9. LIME S.+NOVA (E/L)	9.4 L+0.25 kg	2.6 ab	2.9	0.03	0.05	8.8
10. Untreated check	- -	11.4 ab	6.3	0.26	0.09	10.8
ANOVA P• 0.05		s	ns	ns	ns	ns
Coefficient of Variation (%)		100.6	55.0	153.3	93.0	22.0

* The values in this table are means of four replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

** Disease incidence data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

#156 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 93000480

CROP: Turfgrass, Kentucky Bluegrass, *Poa pratensis* L., cvs. Asset, Barcelona, Cynthia and Midnight

PEST: Powdery mildew, *Erysiphe graminis* DC.
Rust, *Puccinia brachypodii* G. Otth var. *poae-nemoralis* (G. Otth) Cummins & H.C. Greene

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TITLE: EFFICACY OF FOUR FUNGICIDES AGAINST POWDERY MILDEW AND RUST ON KENTUCKY BLUEGRASS AT BROOKS, ALBERTA, IN 1995

MATERIALS: LIME SULPHUR SOLUTION (sulphide sulphur 22% SN); DITHANE DG (mancozeb 75% WG); TILT 250E (propiconazole 250 g/L EC); NOVA 40W (myclobutanil 40% WP); COMPANION AGRICULTURAL ADJUVANT (octylphenoxypolyethoxy-(9)-ethanol 70% SN)

METHODS: Fungicide efficacy trials were conducted in experimental plots of Kentucky Bluegrass grown for seed at CDC-South. The four cultivars used were chosen on the basis of their disease reaction in previous trials at Brooks, i.e. Asset - mildew and rust susceptible; Barcelona - mildew susceptible and rust resistant; Cynthia - mildew resistant and rust susceptible; Midnight - mildew and rust susceptible. Each fungicide treatment (see Tables 1-4) was applied to six, 5 m^2 subplots. A similar set of subplots was sprayed with tapwater as an untreated check. COMPANION, a non-ionic adjuvant, was added to the spray mixes containing NOVA 40W and DITHANE DG at the rate of 1.0 ml/L of mixture. The treatments were arranged in a randomized complete block design with six replications. The sprays were applied with a CO_2-propelled, hand-held boom sprayer equipped with four, Tee Jet 8002 nozzles. The spray was directed over the top of the plant canopy. The grass was 15-20 cm tall and not yet headed out on May 18 when all of the "Early (E)" treatments (nos. 1, 3, 4, 6, 8 and 9), as well as the check, were sprayed for the first time. The equivalent of 200 L/ha of spray mixture was applied to each subplot using a boom pressure of 275 kPa. A trace amount of mildew was noticed in all four cultivars at the time of spraying. No rust was seen in any of the cultivars. On June 9, a second round of spraying for the "Late (L)" treatments (nos. 2, 3, 5, 6, 7, 8 and 9) was done when 80-100 % of the plants were in head, with some mildew showing on the lower leaves and stems; no rust was observed.

On July 19-25, random samples of 100 leaves were collected from each subplot and visually rated for mildew and rust incidence (% leaves affected) and severity (% leaf area diseased), i.e. clean (0) = no mildew/rust; slight (1) = 1-5%, moderate (2) = 6-25%, and severe (3) = >25%. When the heads were mature, 1 m^2 per subplot was harvested from each cultivar and dried, threshed, cleaned and weighed to obtain seed yields. Disease incidence and severity data and seed weights were subjected to analysis of variance (ANOVA). Disease incidence figures were arcsin-transformed prior to ANOVA.

RESULTS: As presented in the tables.
Asset - Moderately high amounts of mildew and high amounts of rust occurred in this cultivar (Table 1). NOVA (L) reduced the incidence of powdery mildew the most, followed by LIME SULPHUR + NOVA (E/L), TILT (E/L), NOVA (E/L) and NOVA (E). Except for TILT (E) and NOVA (E/L), all of the chemical treatments had significantly lower mildew severity ratings than the check. No significant differences in the incidence and severity of rust or in yield were observed between treatments.
Barcelona - Moderate levels of mildew and low levels of rust were observed in this trial (Table 2). TILT (L), TILT (E/L), NOVA (E), NOVA (L), NOVA (E/L), LIME SULPHUR + TILT (E/L) and LIME SULPHUR + NOVA (E/L) were the most effective treatments against mildew. Rust levels were low and none of the fungicides significantly reduced disease levels or increased yield relative to the check.
Cynthia - Mildew infection was extremely low and rust infection was high in this cultivar. None of the fungicides significantly reduced the incidence or severity of either disease or significantly improved the yield compared to the check (Table 3).
Midnight - Moderate levels of mildew and low levels of rust were seen in this trial (Table 4). All of the chemicals tested, except DITHANE DG, significantly reduced the incidence and severity of mildew. Very few significant differences in rust levels were observed between treatments. None of the fungicide-treated plots significantly out yielded the check.

CONCLUSIONS: Adequate levels of disease occurred in most of the cultivars to provide meaningful efficacy tests. Where mildew was prevalent, TILT and NOVA, alone or in combination with LIME SULPHUR, generally provided acceptable control of this disease. Unfortunately, the picture was not as clear with rust, where none of the fungicides tested effectively controlled this disease. Further studies are needed to determine the optimum time to apply foliar fungicides in order to effectively manage rust on bluegrass.

Table 1. Incidence and severity of powdery mildew and rust on Asset bluegrass treated with four fungicides in field plots at Brooks, Alberta, in 1995.*

Treatment	Rate (product/ ha)	Incidence (%)**		Severity (0-3)		Seed yield
		Mildew	Rust	Mildew	Rust	(g/m^2)
1. TILT 250E (Early=E)	0.5 L	17.9 ab	68.4	0.24 ab	1.03	3.27
2. TILT 250E (Late=L)	0.5 L	16.4 abc	65.7	0.14 b	0.83	3.94
3. TILT 250E (E/L)	0.5 L	3.5 bc	52.8	0.04 b	0.67	2.90
4. NOVA 40W (E)	0.25 kg	9.0 bc	66.5	0.11 b	0.92	3.63
5. NOVA 40W (L)	0.25 kg	1.5 c	53.2	0.03 b	0.86	3.71
6. NOVA 40W (E/L)	0.25 kg	4.4 bc	55.7	0.26 ab	0.71	3.24
7. DITHANE DG (L)	2.25 kg	66.1 a	72.4	1.02 c	1.05	3.45
8. LIME S.+TILT (E/L)	9.4 L+0.5 L	14.6 abc	52.4	0.15 b	0.70	2.90
9. LIME S.+NOVA (E/L)	9.4 L+0.25 kg	2.6 bc	64.8	0.05 b	0.84	3.07
10. Untreated check	--	32.9 a	72.1	0.57 a	1.13	3.25
ANOVA P• 0.05		s	ns	s	ns	ns
Coefficient of Variation (%)		60.6	19.0	112.5	41.8	47.2

* The figures in this table are means of six replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

** Disease incidence data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

Table 2. Incidence and severity of powdery mildew and rust on Barcelona bluegrass treated with four fungicides in field plots at Brooks, Alberta, in 1995.*

Treatment	Rate (product/ ha)	Incidence (%)**		Severity (0-3)		Seed yield (g/m^2)
		Mildew	Rust	Mildew	Rust	
1. TILT 250E (Early=E)	0.5 L	22.2 bc	3.5 a	0.33 bc	0.07 ab	34.85
2. TILT 250E (Late=L)	0.5 L	5.1 cd	0.4 ab	0.07 c	0.01 c	32.21
3. TILT 250E (E/L)	0.5 L	1.1 d	0.3 ab	0.02 c	0.02 bc	31.29
4. NOVA 40W (E)	0.25 kg	13.9 cd	3.7 a	0.19 c	0.08 a	26.56
5. NOVA 40W (L)	0.25 kg	2.4 d	0.8 ab	0.09 c	0.02 c	32.35
6. NOVA 40W (E/L)	0.25 kg	0.4 d	0.2 b	0.01 c	0.01 c	24.35
7. DITHANE DG (L)	2.25 kg	64.7 a	0.0 b	0.84 a	0.00 c	28.64
8. LIME S.+TILT (E/L)	9.4 L+0.5 L	6.3 cd	0.2 b	0.08 c	0.01 c	21.35
9. LIME S.+NOVA (E/L)	9.4 L+0.25 kg	1.6 d	1.00 ab	0.03 c	0.02 bc	30.98
10. Untreated check	--	41.2 ab	1.00 ab	0.55 ab	0.02 bc	33.84
ANOVA P• 0.05		s	s	s	s	ns
Coefficient of Variation (%)		71.6	121.3	120.4	173.6	46.2

* The figures in this table are means of six replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

** Disease incidence data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

Table 3. Incidence and severity of powdery mildew and rust on Cynthia bluegrass treated with four fungicides in field plots at Brooks, Alberta, in 1995.*

Treatment	Rate (product/ ha)	Incidence (%)**		Severity (0-3)		Seed yield (g/m^2)
		Mildew	Rust	Mildew	Rust	
1. TILT 250E (Early=E)	0.5 L	0.00	84.8	0.00	1.46 ab	32.01
2. TILT 250E (Late=L)	0.5 L	0.17	79.9	0.00	1.17 bc	27.13
3. TILT 250E (E/L)	0.5 L	0.00	83.9	0.00	1.17 bc	35.00
4. NOVA 40W (E)	0.25 kg	0.00	85.1	0.00	1.65 a	37.09
5. NOVA 40W (L)	0.25 kg	0.00	80.1	0.00	1.17 bc	27.39
6. NOVA 40W (E/L)	0.25 kg	0.83	76.7	0.01	1.07 c	30.10
7. DITHANE DG (L)	2.25 kg	0.00	83.0	0.00	1.28 bc	24.37
8. LIME S.+TILT (E/L)	9.4 L+0.5 L	0.50	82.2	0.01	1.18 bc	33.51
9. LIME S.+NOVA (E/L)	9.4 L+0.25 kg	0.00	75.3	0.00	1.10 bc	30.47
10. Untreated check	--	0.00	82.1	0.00	1.31 abc	41.93
ANOVA P• 0.05		ns	ns	ns	s	ns
Coefficient of Variation (%)		470.5	8.8	470.5	21.8	28.3

* The figures in this table are means of six replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

** Disease incidence data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

Table 4. Incidence and severity of powdery mildew and rust on Midnight bluegrass treated with four fungicides in field plots at Brooks, Alberta, in 1995.*

Treatment	Rate (product/ ha)	Incidence (%)**		Severity (0-3)		Seed yield (g/m^2)
		Mildew	Rust	Mildew	Rust	
1. TILT 250E (Early=E)	0.5 L	2.3 b	3.4	0.10 b	0.05	11.39 b
2. TILT 250E (Late=L)	0.5 L	1.1 b	0.8	0.02 b	0.02	16.18 ab
3. TILT 250E (E/L)	0.5 L	0.3 b	0.5	0.00 b	0.02	14.02 ab
4. NOVA 40W (E)	0.25 kg	1.7 b	4.1	0.05 b	0.08	12.22 b
5. NOVA 40W (L)	0.25 kg	1.5 b	1.5	0.03 b	0.04	13.07 ab
6. NOVA 40W (E/L)	0.25 kg	0.4 b	4.9	0.01 b	0.09	12.15 b
7. DITHANE DG (L)	2.25 kg	53.0 a	3.8	0.56 a	0.07	13.97 ab
8. LIME S.+TILT (E/L)	9.4 L+0.5 L	0.3 b	0.7	0.02 b	0.02	18.07 a
9. LIME S.+NOVA (E/L)	9.4 L+0.25 kg	1.4 b	1.0	0.04 b	0.03	18.34 a
10. Untreated check	--	25.4 a	3.9	0.37 a	0.08	14.20 ab
ANOVA P• 0.05		s	ns	s	ns	ns
Coefficient of Variation (%)		113.6	81.8	165.3	123.5	28.5

* The figures in this table are means of six replications. Numbers within a column followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P• 0.05).

** Disease incidence data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

RESIDUE STUDIES / ÉTUDES SUR LES RÉSIDUS

Section Editor / Réviseur de section : B.D. Ripley

#157 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 387-1431-8312

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TITLE: QUINCLORAC PERSISTENCE UNDER DIFFERENT SOIL MOISTURE REGIMES

MATERIALS: BAS-514 34 H (quinclorac)

METHODS: The effect of different simulated rainfall regimes on quinclorac dissipation in Lethbridge soil was assessed in lysimeters located under a movable roof which excluded natural rainfall. The soil was a sandy clay loam (52% sand, 25% clay, 23% silt), with pH 8.0, OM 2.0% and FC 18% @300mb. Quinclorac (75% DF) was applied at 300 g/ha on June 1, 1994, by removing the top 5.1 cm of soil (initial moisture 9.9%, initial bulk density 1.12 g/cm3) from the 56-cm i.d. lysimeters, atomizing a quinclorac solution onto the soil with mixing in a cement mixer, and returning the soil to the lysimeters. Immediately after herbicide treatments, wheat was seeded into the treated soil, three 40-cm rows per lysimetre. Over the next four months, simulated rainfall was applied to the lysimeters to match the pattern (2-6 events per month) and average total amounts of June-September rainfall for three of the driest years on record (total = 113 mm), three years with below normal rainfall (164 mm), three normal years (212 mm), three years with greater than normal rainfall (246 mm), and three of the wettest years on record (375 mm). The soil was not watered and natural moisture excluded over the winter months (October 1994 - March 1995). Simulated rainfall regimes were resumed in April, 1995. The experimental design consisted of four replicates of the six treatments (treated soil under five moisture regimes and an untreated blank under normal moisture regime) laid out in a randomized block design. At intervals (0, 3, 6, 12, 20, 48 week) after treatment, the 10.2-cm top layer of soil was sampled by compositing five 2.94-cm i.d. core samples/lysimetre. Wooden dowels were placed in the holes after sampling to maintain the integrity of residue distribution in the soil. Samples were air-dried overnight, ground, mixed, subsampled (40 g) and stored at -35• C until analysis. The residue analysis method consisted of three acetone/NaOH/water extractions, followed by liquid-liquid partitioning into dichloromethane under acidic conditions, esterification with diazomethane, cleanup using an acid alumina column, and quantitation by ECD-GLC. Mean (n = 15) method recoveries from samples spiked at 20-500 ppb were 102.0 +-9.0% (SD).

RESULTS: Results are presented (see Table below) for the normal and extreme moisture regimes only; results for the other two regimes were intermediate as expected. For comparison on a consistent basis across moisture regimes, the quinclorac residues are presented on a total ugs/5-core sample basis rather than a ppb basis because, with the large differences in watering, the bulk density of the soil varied among moisture regimes. On a ppb basis, residues ranged from

243-261 ppb at week-0, to 106-172 ppb at week-48.

CONCLUSION: Quinclorac residues will persist into the next crop year in Lethbridge soil. The amount of residue carryover (45-85% of initial residues) will vary with soil moisture conditions. Further studies are required to determine the biological availability of carried-over residues.

Table 1.

		Quinclorac residues detected in Lethbridge soil*		
Date	Weeks after treatment	Very dry moisture Tugs+-SD (%)	Normal moisture Tugs+-SD (%)	Very wet moisture Tugs+-SD (%)
Jun 01	0	78.5+-2.5(100)	88.4+-4.9(100)	85.9+-2.7(100)
Jun 20	3	88.2+-10 (112)	80.9+-15 (92)	75.8+-12 (88)
Jul 13	6	90.2+-2.5(115)	79.1+-8.9(89)	60.7+-4.1(71)
Aug 23	12	74.9+-6.8(95)	64.8+-18 (73)	44.9+-7.5(52)
Oct 17	20	67.1+-6.3(85)	53.0+-14 (60)	42.9+-1.9(50)
May 02	48	74.8+-4.9(95)	46.0+-20 (52)	41.1+-9.7(48)

* Residues detected per 5-core sample (33.9 cm^2 x 10.2 cm depth). Each Tugs (total micrograms) value is a mean+-SD of 4 replicates. The theoretical week-0 recovery based on 300 g/ha applied was 102 ug.

#158 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61006457

CROP: Broccoli, Chinese, cv. Guy Lon
Cabbage, Thick mustard cabbage, cv. Pak Choi
Cabbage, Chinese cabbage, cv. Kasumi

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TITLE: INSECTICIDE RESIDUE IN CHINESE BROCCOLI, PAK CHOI AND CHINESE CABBAGE

MATERIALS: BELMARK 300 EC (fenvalerate)

METHODS: Chinese broccoli, pak choi and Chinese cabbage were transplanted at the Holland Marsh on muck soil. Each plot consisted of 3 rows, 6 m long, replicated 4 times. The treatments were applied at the rate of 500 L of water/ha with a tractor-mounted sprayer. BELMARK was applied four times at weekly intervals at the rate of 97.5 g a.i./ha. The crop was treated prior to harvest and sampled at various intervals when the crop was mature. Samples were analysed for residue (methods of analyses available on request).

RESULT: As presented in the Table below.

CONCLUSION: Residue of fenvalerate decreased significantly from day of application to day 14 in the three crops. The residue was not below 0.1 mg/kg ("negligible") residue limit by day 21 in pak choi and Chinese cabbage.

Table 1.

Residue of fenvalerate in Chinese broccoli, pak choi and Chinese cabbage when the insecticide was applied four times at weekly intervals prior to harvest.*

Days after 4th application	Residue (mg/kg)** Chinese broccoli	pak choi	Chinese cabbage
0	6.25a***	2.08a	3.03a
3	1.58b	1.43b	1.80b
5	0.97c	0.81c	1.32c
7	0.88c	0.61cd	0.88d
10	0.34d	0.40de	0.57de
14	0.20d	0.29de	0.38ef
21	0.03d	0.14e	0.11f

* Treated August 5, 15, 18 and 25, 1995.

** Mean of 4 replicates.

*** Means followed by the same letter are not significantly different (P• 0.05; LSD test).

#159 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 84100761

CROP: Lettuce, Head lettuce, cv. Ithaca
Lettuce, Romaine lettuce, cv. Parris Island
Endive, cv. Green Curled

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TITLE: INSECTICIDE RESIDUE IN HEAD LETTUCE, ROMAINE LETTUCE AND ENDIVE

MATERIALS: RIPCORD 400 EC (cypermethrin)

METHODS: Head lettuce, romaine and endive were transplanted at the Holland Marsh on muck soil. Each plot consisted of 4 rows, 6 m long, replicated 4 times. The treatments were applied at the rate of 375 L of water/ha with a tractor-mounted sprayer. Cypermethrin was applied at the rate of 50 g a.i./ha. The crop was treated prior to harvest and sampled at various intervals when the crop was mature. Samples were analysed for residue (methods of analyses available on request).

RESULT: As presented in the Table below.

CONCLUSION: The residue of cypermethrin in head lettuce and endive was below 0.1 mg/kg ("negligible") residue limit by day 14, the pre-harvest interval. The residue in romaine lettuce was below 0.1 mg/kg by day 19.

Table 1. Residue of cypermethrin in head lettuce, romaine lettuce and endive when the insecticide was applied prior to harvest.*

Days after 4th application	Residue (mg/kg)**		
	head lettuce	romaine lettuce	endive
0	0.61a***	1.83a	4.15a
1	0.44b	1.60b	2.68b
3	0.26c	0.68c	0.85c
7	0.03d	0.22d	0.26cd
10	0.02d	0.18de	0.18d
14	0.03d	0.16de	0.07d
19	0.01d	0.02e	0.01d

* Treated August 8, 1995.

** Mean of 4 replicates.

*** Means followed by the same letter are not significantly different (P• 0.05; LSD test).

PESTICIDE AND CHEMICAL DEFINITION / PESTICIDES ET DÉFINITIONS DES PRODUITS CHIMIQUES

PESTICIDE	ALTERNATIVE DESIGNATION(S)
1,2-dichloropropane	1,2-DICHLOROPROPANE
1,3-dichloropropene	TELONE; TELONE II-B
2,4-D	2,4-D ACID; 2,4-D ACIDE; 2,4-D-ACID; 2,4-DICHLOROPHENOXYACETIC ACID; DESORMONE; DRIAMINE; FORMULA 40; UBI-2323
2,4-D dimethylamine	2,4-D DIMETHYLAMINE
2,4-D ester	2,4-D ESTER
ABAMECTIN	avermectin b1
ABG-6263	*B. thuringiensis tenebrionis*
ABG-6271	*B. thuringiensis tenebrionis*
ABG-6275	*B. thuringiensis tenebrionis*
AC 303,630	confidential
AC 301,467	terbufos
ACECAP	acephate
acephate	ACECAP; ORTHENE; ORTHO-12-420
ACR-3675	pyrifenox
ACR-3815	mancozeb + pyrifenox
acrinathrin	RU-38702; RUFAST
ADMIRE	imidacloprid
AFUGAN	pyrazophos
AGRAL 90	nonylphenolethylene oxide
AGRI-MYCIN	streptomycin
AGRICULTURAL STEPTOMYCIN	streptomycin
AGRIDYNE	azadirachtin
AGRIKELP	seaweed
AGRISTREP	streptomycin
AGROSOL	captan + thiabendazole
AGROSOL POUR-ON	thiram + thiabendazole; AGROSOL T
AGROSOL T	thiram + thiabendazole
AGROX	maneb
AGROX B-3	B-3; captan + diazinon + lindane
AGROX D-L PLUS	captan + diazinon + lindane; AGROX DL PLUS
AGROX DB	maneb
AGROX DL PLUS	captan + diazinon + lindane
AGROX FLOWABLE	maneb
AGROX NM	maneb
AGSCO A-4452	fenbuconazole
AGSCO A-4452 PLUS	fenbuconazole + lindane
AGSCO DB	lindane + maneb
aldicarb	TEMIK
ALDRIN	HHDN
ALIETTE	fosetyl-al
ALIGN	azadirachtin
allidochlor	RANDOX
ALPHA-CYPERMETHRIN	cypermethrin-alpha
AMAZE	isofenphos
AMBUSH	permethrin
amitraz	MITAC
ANCHOR	carbathiin + thiram; UBI-2359-2
anilazine	DYRENE
ANVIL	hexaconazole
APM	azinphos-methyl
APOLLO	clofentezine

APRON	metalaxyl
APRON-T	APRON-T 69
APRON-T 69	metalaxyl + thiabendazole; APRON-T
ARREST	carbathiin + oxycarboxin + thiram
ASC-66518	confidential
ASC-66792	confidential
ASC-66824	FOSTHIAZATE
ASC-66825	experimental
ASC-66884	unknown
ASC-66895	biocontrol bacteria
ASC-66897	experimental
ASC-67089	experimental
ASC-67090	experimental
ASC-67091	experimental
ASC-67092	experimental
ASC-67093	experimental
ASC-67098	experimental
ASC-67098Z	unknown
ASC-67178	fluazinamX + fluazinamY
ASCE-RCT60	unknown
Ascophyllum nodosum extract	MICRO-MIST
ASIMICIN	Paw Paw bark extract
Asimina triloba extract	Paw Paw bark extract
ASSIST	adjuvant; ASSIST OIL; ASSIST OIL CONCENTRATE
ASSIST OIL	adjuvant
ASSIST OIL CONCENTRATE	adjuvant
ATPLUS 463	surfactant
atrazine	AATREX; ATRAMIX
ATROBAN	permethrin
ATROBAN DELICE POUR-ON	permethrin
avermectin b1	ABAMECTIN; AVID
AVID	avermectin b1
AVON-SKIN-SO-SOFT	AVON-SKIN-SO-SOFT (repellant)
Azadirachta indica extract	azadirachtin
azadirachtin	AGRIDYNE; ALIGN; *Azadirachta indica* extract; AZADIRACHTIN SOLUTION 1; AZADIRACHTIN SOLUTION 2; MARGOSAN-O; NEEM; NEEM SOLUTION 1; NEEM SOLUTION 2; NEEMIX; SAFERS NEEM INSECTICIDE; SNI OIL
AZADIRACHTIN SOLUTION 1	azadirachtin
AZADIRACHTIN SOLUTION 2	azadirachtin
azinphos-methyl	APM; GUTHION
azoxystroboin	ICIA-5504
AZTEC	cyfluthrin + phostebupirim; cyfluthrin + tebupirimphos
B-3	captan + diazinon + lindane; AGROX B-3; CHIPMAN B-3
B. thuringiensis Berliner	*BACILLUS THURINGIENSIS*
B. thuringiensis israelensis	VECTOBAC
B. thuringiensis kurstaki	*BACILLUS THURINGIENSIS KURSTAKI*; BACTOSPEINE; CGA-237218; CONDOR; CUTLASS; DIPEL; EG-2371; FORAY; FUTURA; FUTURA XLV; JAVELIN; MYX-2284; ORGANIC INSECT KILLER LIQUID; THURICIDE; THURICIDE-HPC
B. thuringiensis san diego	M-ONE; M-ONE MYD; M-TRAK; MYX-9858
B. thuringiensis tenebrionis	ABG-6263; ABG-6271; ABG-6275; DITERA;

	NOVODOR; SAN-418; TRIDENT; TRIDENT II
BACILLUS SUBTILIS	*B. subtilis*
BACILLUS THURINGIENSIS	*B. thuringiensis* Berliner
BACILLUS THURINGIENSIS KURSTAKI	*B. thuringiensis kurstaki*
BACTOSPEINE	*B. thuringiensis kurstaki*
BANISECT	chlorpyrifos
BANNER	propiconazole
BANVEL	dicamba
BAS-152	dimethoate
BAS-152-47	dimethoate
BAS-300	unknown
BAS-490	a strobilurine analogue
BAS-9078	confidential
BAS-9082	fenpropathrin
BAS-9102	benfuracarb
BASIC COPPER SULPHATE	tribasic copper sulphate
BASIC H	unknown
BASF-152	dimethoate
BASUDIN	diazinon
BAY-HWG-1608	tebuconazole
BAY-MAT-7484	phostebupirim
BAY-NTN-19701	MONCEREN; PENCYCURON
BAY-NTN-33893	imidacloprid
BAYCOR	bitertanol
BAYGON	propoxur
BAYLETON	triadimefon
BAYTAN	triadimenol
BAYTHROID	cyfluthrin
BELMARK	fenvalerate
benalaxyl	GALBEN; TF-3651; TF-3772; TF-3773
bendiocarb	TRUMPET
benfuracarb	BAS-9102; ONCOL
BENLATE	benomyl
benodanil	CALIRUS
BENOLIN R	benomyl + lindane + thiram
benomyl	BENLATE
bentazon	BAS-501-06; BASAGRAN; LADDOCK
BERET	CGA-142705
BERET MLX	CGA-142705 + metalaxyl
BHC	lindane
bifenthrin	BRIGADE; CAPTURE; TALSTAR; UBI-2701
binderdispersion V-406	BINDERDISPERSION
BIODAC	adjuvant
BIOLURE CONSEP MEMBRANE LURE	pheromone
BIRLANE	chlorfenvinphos
bitertanol	BAYCOR
BL-1104	experimental bactericide
BOND	adjuvant
BORDEAUX MIXTURE	calcium hydroxide + copper sulphate
BOTRAN	dichloran
BOVAID	fenvalerate
BOVITECT	permethrin
BRACO WOUND DRESSING	unknown
BRAVO	chlorothalonil
BRAVO 500	chlorothalonil
BRAVO 90DG	chlorothalonil
BRAVO C/M	chlorothalonil + copper oxychloride + maneb
BRIGADE	bifenthrin
brodifacoum	VOLID
BROMINAL M	bromoxynil + MCPA; BUCTRIL M

bromoxynil	PARDNER
BUCTRIL M	bromoxynil + MCPA
BUTACIDE	piperonyl butoxide
butylate	SUTAN
calcium acetate	CALCIUM ACETATE
calcium carbonate	lime
calcium chloride	CALCIUM CHLORIDE
calcium hydroxide	CALCIUM HYDROXIDE
calcium nitrate	CALCIUM NITRATE
calcium phosphate	CALCIUM PHOSPHATE
calcium sulfate	GYPSUM
CALIRUS	benodanil
CANPLUS	CANPLUS 411; adjuvant
captafol	DIFOLATAN; SPRILLS; SULFONIMIDE
captan	MAESTRO; ORTHOCIDE; ZENECA1
CAPTURE	bifenthrin
carbaryl	SEVIMOL; SEVIN; SEVIN XLR; SEVIN XLR PLUS
carbathiin	CARBOXIN; UBI-2092; UBI-2092-1; UBI-2100; UBI-2100-2; UBI-2100-4; VITAFLO 250; VITAVAX; VITAVAX SINGLE SOLUTION; VITAVAX SOLUTION
carbendazim	BAS-3460; BAVISTIN; BCM; DELSENE; DEROSAL; DPX-10; DPX-965; GRANANIT; HOE-17411; LIGNASAN-P; MBC; MCAB
carbofuran	FURADAN; FURADAN CR-10; UBI-2501
CARBOXIN	carbathiin
CARPOVIRUSINE	granulosis virus
CARZOL	formetanate
CASCADE	flufenoxuron; WL-115110
CATALYST	citric acid + fertilizers + molasses
CC-16238B	diniconazole
CC-16239	diniconazole
CC-16239A	diniconazole
CC-16348	diniconazole
CC-16359	diniconazole
CC-16378	diniconazole
CC-16394	diniconazole
CC-16395	diniconazole
CC-16461	diniconazole
CC-16462	diniconazole
CC-16464	diniconazole
CC-16481	diniconazole
CC-16488	diniconazole
CC-16553	diniconazole
CC-16555	diniconazole
CC-16557	diniconazole
CC-16558	diniconazole
CC-16681	diniconazole
CC-16683	diniconazole
CC-16685	diniconazole
CC-16687	diniconazole
CC-16688	diniconazole
CC-16696	diniconazole
CC-16697	diniconazole
CC-16698	diniconazole
CC-16699	diniconazole
CC-16700	diniconazole
CC-16859	diniconazole

CC-16860	diniconazole
CC-16862	diniconazole
CC-16864	diniconazole
CC-16865	diniconazole
CC-16866	diniconazole
CC-16867	diniconazole
CC-16882	diniconazole
CC-16896	diniconazole
CERONE	ethephon
CGA-12223	isazofos
CGA-142705	BERET
CGA-169374	difenoconazole; DRAGAN
CGA-173506	fludioxonil; MAXIM
CGA-237218	*B. thuringiensis kurstaki*
CGA-453	A-7924-B
CGF-4280	flutolanil; NNF-136
CHARGE	cyhalothrin-lambda
CHEVRON	sticker
chinomethionat	MORESTAN
CHIPMAN B-3	B-3; captan + diazinon + lindane
chitine	CHITINE
CHITOSAN	poly-d-glucosamine
chloranil	SPERGON
chlorbromuron	CHLOROBROMURON; MALORAN
chlordane	ASPON; BELT; CHLORDAN
chlorethoxyfos	DPX-42989; FORTRESS
chlorfenvinphos	BIRLANE
chlormequat	CYCOCEL
chloroneb	DEMOSAN; DPX-1823; PROTURF FII; SCOTTS PROTURF; TERSAN; TERSAN SP
chlorophacinone	ROZOL
chlorothalonil	BRAVO; BRAVO 500; BRAVO 90DG; DACONIL; DACONIL 2787; DACONIL ULTREX
chlorpyrifos	BANISECT; DURSBAN; DURBAN TURF; LORSBAN UBI-2679
chromium yeast	CHROMIUM YEAST
CITOWETT	CITOWETT PLUS; adjuvant
citric acid	CITRIC ACID
clay	CLAY
CLEAN CROP COPPER SPRAY	tribasic copper sulfate
CLEARWING BORER LURE	pheromone
CLOAK	carbathiin + lindane + thiram
cloethocarb	LANCE; UBI-2559; UBI-2562
clofentezine	APOLLO
COAX	organic insecticide
COCONUT MILK EXTRACT	masbrane
codlemone	CODLING MOTH PHEROMONES
CODLING MOTH GRANULOSIS VIRUS	granulosis virus
CODLING MOTH PHEROMONES	codlemone
COMPANION	octylphenoxypolyethoxyethanol n-butanol
CONDOR	*B. thuringiensis kurstaki*
CONFIRM	tebufenozide
COOPERS DELICE POUR-ON	permethrin
copper	COPAC
copper oxides	PERECOT
copper oxychloride	NIAGARA FIXED COPPER
copper salts of rosin & fatty acids	TENN-COP
COPPER SPRAY	tribasic copper sulphate
copper sulphate	COPPER SULFATE; tribasic copper sulphate
CORBEL	fenpropimorph

COUNTER	terbufos
CPGV	granulosis virus
cresol	M-CRESOL; META-CRESOL
CROWN	carbathiin + thiabendazole
CRYOLITE	KRYOCIDE; sodium aluminum fluoride
CUB	tribasic copper sulphate
CULTAR	paclobutrazol
cupric hydroxide	COPPER HYDROXIDE; KOCIDE
CUPRIC SULFATE TRIBASIC	tribasic copper sulphate
CUTLASS	*B. thuringiensis kurstaki*
CYCOCEL	chlormequat
cyfluthrin	BAYTHROID
CYGON	dimethoate
CYGUARD	phorate + terbufos; CYGARD
cyhalothrin	GRENADE; PP-563
cyhalothrin-lambda	CHARGE; ICIA-0321; KARATE; LAMBDA-CYHALOTHRIN; PP-321
CYMBUSH	cypermethrin
cypermethrin	CYMBUSH; DEMON; RIPCORD
cypermethrin-alpha	ALPHA-CYPERMETHRIN; FASTAC
CYPREX	dodine
cyproconazole	SAN-619; UBI-2565; UBI-2575
cyromazine	TRIGARD
CYTHION	malathion
D-D	1,2-dichloropropane + 1,3-dichloropropene
DACOBRE	chlorothalonil
DACONIL	chlorothalonil
DACONIL 2787	chlorothalonil
DACONIL ULTREX	chlorothalonil
DADS	diallyl disulphide mixture + diallyl sulphide
DANITOL	fenpropathrin
DASANIT	fensulfothion
DB GREEN	lindane + maneb
DCT	captan + diazinon + thiophanate-methyl
DDT	ZEIDANE
DECIS	deltamethrin
deet	NERO INSECT REPELLENT SOLUTION; SKINTASTIK; ULTRATHON
delta-endotoxin of *B.t. kurstaki*	M-CAP; MVP BIOINSECTICIDE delta-endotoxin of *B.t.* kurstaki-tenebrionis; FOIL
delta-endotoxin of *B.t. san diego*	M-ONE PLUS; MYX-1806; SPUD-CAP
deltamethrin	DECIS
DEMON	cypermethrin
DERITOX	rotenone
DEVRINOL	napropamide
DEXON	fenaminosulf
DI-SYSTON	disulfoton
diatomaceous earth	INSECT STOP; INSECTAGON; INSECTAWAY; SHELLSHOCK
diazinon	BASUDIN; UBI-2291
DIBROM	naled
dicamba	BANVEL
dicamba-dimethylamine	DICAMBA-DIMETHYLAMINE
dichlone	PHYGON
dichloran	BOTRAN
dichlorprop	dichlorprop
dichlorvos	VAPO
diclofop-methyl	CHOE-190Q; DICHLOFOP METH; DICLOFOP; HOE-GRASS; HOELON; ILLOXAN
dicofol	KELTHANE

dieldrin	HEOD
dienochlor	PENTAC AQUAFLOW
difenoconazole	CGA-169374; DIVIDEND; DRAGON
diflubenzuron	DIMILIN
DIKAR	dinocap + mancozeb
dimethoate	BAS-152; BAS-152-47; BASF-152; CYGON; HOPPER-STOPPER; LAGON; SYSTEM
DIMILIN	diflubenzuron
diniconazole	CC-16238B; CC-16239; CC-16239A; CC-16348; CC-16359; CC-16378; CC-16394; CC-16395; CC-16461; CC-16462; CC-16464; CC-16481; CC-16488; CC-16553; CC-16555; CC-16557; CC-16558; CC-16681; CC-16683; CC-16685; CC-16687; CC-16688; CC-16696; CC-16697; CC-16698; CC-16699; CC-16700; CC-16859; CC-16860; CC-16862; CC-16864; CC-16865; CC-16866; CC-16867; CC-16882; CC-16896; SPOTLESS; XE-779
DINITRO	dinoseb
dinocap	KARATHANE
dinoseb	DINITRO
DIPEL	*B. thuringiensis kurstaki*
diphacinone	RAMIK BRUN
diquat	REGLONE
disulfoton	DI-SYSTON
DITERA	*B. thuringiensis tenebrionis*
DITHANE 480F	mancozeb
DITHANE DF	mancozeb
DITHANE DG	mancozeb
DITHANE F-45	mancozeb
DITHANE M-22	maneb
DITHANE M-45	mancozeb; DITHANE M45
diuron	DMU; KARMEX
difenoconazole	CGA-169374
DIVIDEND	difenoconazole; CGA-169374
dodine	CYPREX; EQUAL
DOGWOOD BORER LURE	pheromone
DOWCO-429	DOWCO-429X; unknown
DOWCO-473	unknown; XRD-473
DPDS	n-propyl disulphide
DPX-43898	SD-208304
DPX-H6573	flusilazole
DRAGAN	CGA-169374
DUAL	metolachlor
DURSBAN	chlorpyrifos
DURSBAN TURF	chlorpyrifos
DYFONATE	fonofos
DYFONATE II	fonofos
DYFONATE ST	fonofos
DYLOX	trichlorfon
DYRENE	anilazine
DYVEL	herbicide
EASOUT	thiophanate-methyl
ECTIBAN	permethrin
EG-2371	*B. thuringiensis kurstaki*
EL-228	nuarimol
ELITE	tebuconazole
EMBARK	mefluidide

emulsifiable spray oil	SUNSPRAY
endosulfan	THIODAN
ENHANCE	surfactant
ENTICE	organic insecticide
ESTAPROP	diclorprop + 2,4-D ester
EPIC	furmecyclox
EPTC	EPTAM
EQUAL	dodine
esfenvalerate	HALMARK
estraprop	2,4-D ester + dichlorprop
ethalfluralin	EDGE; EL-161; SONALAN
ethephon	CERONE
ethion	DIETHION; NIALATE
ETHOPROP	ethoprophos
ethoprophos	ETHOPROP
ETHYLTRIANOL	tebuconazole
etridiazole	TRUBAN
EVISECT	thiocyclam-hydrogenoxalate
EXP-2022C	copper oxychloride + fosetyl-al
EXP-2164B	iprodione
EXP-6003A	unknown
EXP-60707A	experimental
EXP-6043A	organic insecticide; FIPRONIL
EXP-10295A	unknown
EXP-10370A	iprodione
EXP-60145A	confidential
EXP-60655A	confidential
EXP-8005A	thiodicarb
EXP-80240A	organic fungicide
EXP-80287A	organic fungicide
EXP-80290A	organic fungicide
EXP-80318A	triticonazole
EXP-80362A	organic fungicide
EXP-80363A	organic fungicide
EXP-80364A	organic fungicide
EXP-80365A	organic fungicide
EXP-80366A	organic fungicide
EXP-80367A	organic fungicide
EXP-80415A	fipronil
EXP-80430B	unknown
EXP-80511A	unknown
EXP-80576A	triticonazole
EXP-80577A	triticonazole
EXP-80578A	triticonazole
EXP-80590A	iprodione
EXP-80591A	iprodione + triticonazole

F020	Paw Paw bark extract
FASTAC	cypermethrin-alpha
fenaminosulf	DEXON; LESAN
fenamiphos	NEMACUR
fenapanil	SISTHANE
fenbuconazole	AGSCO A-4452
fenbutatin oxide	TORQUE; VENDEX
fenitrothion	SUMITHION
fenpropathrin	BAS-9082; DANITOL; S-3206
fenpropimorph	CORBEL; MISTRAL
fensulfothion	DASANIT
fenthion	PVC EAR TAG

fenvalerate	BELMARK; BOVAID
ferbam	FERMATE
fertilizers	SUSTANE
FIPRONIL	EXP-6043A
fish liquid extract	fish extract
FLO-PRO-IMZ	imazalil
fluazinam	B-1216; IKF-1216
fludioxonil	CGA-173506; MAXIM
flucythrinate	GUARDIAN
flufenoxuron	CASCADE; WL-115110
flusilazole	DPX-H6573; NUSTAR
flutolanil	CGF-4280; MONCUT; NNF-136
flutriafol	ICIA-0450; MINTECH; TF-3673; TF-3675; TF-3753; TF-3765; TF-3775
FOIL	delta-endotoxin of *B.t. kurstaki-tenebrionis*
FOLICOTE	tebuconazole
FOLICUR	tebuconazole
FOLPAN	folpet
folpet	PHALTAN; FOLPAN
fonofos	DYFONATE; DYFONATE II; DYFONATE ST
FORAY	*B. thuringiensis kurstaki*
FORCE	tefluthrin
FORE	mancozeb
formetanate	CARZOL
fosetyl-al	ALIETTE
FOSTHIAZATE	ASC-66824
FRANIXQUERRA	sodium dioctyl sulfosuccinate
FRIGATE	mineral oil
FUNGAFLOR	imazalil
FUNGINEX	triforine
FURADAN	carbofuran
FURADAN CR-10	carbofuran
furathiocarb	PROMET
furmecyclox	EPIC
FUTURA	*B. thuringiensis kurstaki*
FUTURA XLV	*B. thuringiensis kurstaki*

G-696	UBI-2563
GALBEN	benalaxyl
GALLEX	2,4-xylenol + cresol
GAMMA-BHC	lindane
GAOZHIMO	masbrane
GAUCHO	imidacloprid
glyphosate	ROUNDUP
granulosis virus	CARPOVIRUSINE; CODLING MOTH GRANULOSIS VIRUS; CPGV; UCB-87
GREATER PEACH TREE BORER LURE	pheromone
GSX-8743	GXS-8743
GUARDIAN	flucythrinate
GUARDSMAN SURFACE TENSION REDUCER	surfactant
GUTHION	azinphos-methyl
GX SOAP	soap
GXS-8743	GSX-8743
GYPSUM	calcium sulfate

HALMARK	esfenvalerate
hexaconazole	ANVIL; ICIA-0523; JF-9480; TF-3770; TF-9480; WF-2228

hexythiazox	SAVEY
HHDN	ALDRIN
HOE-000522	teflubenzuron
HOE-00522	teflubenzuron
HOLLYSUL MICRO-SULPHUR	sulphur
HOPPER-STOPPER	dimethoate
HWG-1608	tebuconazole
hydrated lime	hydrated lime
hymexazol	TACHIGAREN; UBI-2631

IB-11522	chlorothalonil + fluazinam
IB-11925	chlorothalonil
IB-11953	chlorothalonil
ICIA-0321	cyhalothrin-lambda
ICIA-0450	flutriafol
ICIA-0523	hexaconazole
ICIA-0993	tefluthrin
ICIA-5504	azoxystroboin
imazalil	FLO-PRO IMZ; FUNGAFLOR; NU-ZONE; UBI-2420
imazethapyr	AC 263,499; AC-263499; PURSUIT
imidacloprid	BAY-NTN-33893; GAUCHO; NTN-33893; UBI-2627
IMIDAN	phosmet
INCITE	piperonyl butoxide
INSECOLO	silicon dioxide
INSECT STOP	diatomaceous earth
INSECTAGON	diatomaceous earth
INSECTAWAY	diatomaceous earth
INSEGAR	RO-13-5223
iodine	IODINE
ioxynil	ACTRIL; CERTOL; CERTROL; TORTRIL; TOTRIL
iprodione	EXP-10370A; EXP-2164B; ROVRAL; ROVRAL FLO; ROVRAL GREEN
isazofos	CGA-12223; TRIUMPH
ISK-66824	unknown
ISK-66895	unknown
ISOBUTYLIDENE DIUREA	fertilizer
isofenphos	AMAZE
ISOMATE C	pheromone
ivermectin	IVOMEC
IVOMEC	ivermectin
IVORY LIQUID	soap

JAVELIN	*B. thuringiensis kurstaki*
JAVEX	sodium hypochlorite
JF-9480	hexaconazole

KARATE	cyhalothrin-lambda
KARATHANE	dinocap
KELTHANE	dicofol
KILLEX TURF HERBICIDE	2,4-D dimethylamine + dicamba-dimethylamine + mecoprop dimethylamine; KILMOR
KILMOR	KILLEX TURF HERBICIDE
KOCIDE 101	copper + cupric hydroxide
KODIAK CONCENTRATE	*Bacillus subtilis*
KORN OIL CONCENTRATE	korn oil
KORNTROL OIL	mineral oil
KRYOCIDE	CRYOLITE; sodium aluminum fluoride

KUMULUS	sulphur; KUMULUS S
LAGON	dimethoate
LAMBDA-CYHALOTHRIN	cyhalothrin-lambda
LANCE	cloethocarb
LANNATE	methomyl
LATRON	adjuvant; LATRON B-1956
LATRON B-1956	adjuvant; LATRON
leptophos	ABAR; PHOSVEL
LESAN	fenaminosulf
lime sulphur	SULPHIDE SULPHUR
lindane	BHC; GAMMA-BHC; UBI-2599
linuron	AFALON; AFOLAN; LOROX
LI700	buffer
LIQUIDUSTER	permethrin
LORSBAN	chlorpyrifos
M-CAP	delta-endotoxin of *B.t. kurstaki*
M-ONE	*B. thuringiensis san diego*
M-ONE MYD	*B. thuringiensis san diego*
M-ONE PLUS	delta-endotoxin of *B.t. san diego*
M-TRAK	*B. thuringiensis san diego*
MAESTRO	captan
MAINTAIN	maleic hydrazide
malathion	CYTHION
maleic hydrazide	MAINTAIN; ROYAL MH
MANEX C-8	cymoxanil + mancozeb
mancozeb	DITHANE 480F; DITHANE DF; DITHANE DG; DITHANE F-45; DITHANE M-45; DITHANE M45; MANZATE 200; MANZATE DF; PENNCOZEB; TF-3710
maneb	AGROX; AGROX DB; AGROX FLOWABLE; DITHANE M-22; MANZATE; POOL NM; TF-3767; TF-3767B
MANZATE	maneb
MANZATE 75	mancozeb
MANZATE 200	mancozeb
MANZATE DF	mancozeb
MARGOSAN-O	azadirachtin
masbrane	COCONUT MILK EXTRACT; GAOZHIMO
MAT-7484	phostebupirim
MAXIM	fludioxonil
MCPA	AGRITOX; AGROXONE; CORNOX M; MCP
mecoprop dimethlamine	MECOPROP DIMETHLAMINE
mefluidide	EMBARK
MERCURIC BICHLORIDE	mercuric chloride
mercuric chloride	MERCURIC BICHLORIDE
MERGAMMA FL	TF-3769
MERGAMMA NM	lindane + maneb
MERSIL	mercuric chloride + mercurous chloride
MERTECT	thiabendazole
MESUROL	methiocarb
metalaxyl	APRON; RIDOMIL; SUBDUE; UBI-2379
METASYSTOX-R	oxydemeton-methyl
methamidophos	MONITOR
methidathion	SUPRACIDE
methiocarb	MESUROL
methomyl	LANNATE
methoxychlor	MARLATE; METHOXY-DDT

methyl cellulose	CANOCOTE COMMERCIAL COAT; CANOCOTE MICROPELLET; HILLESHOG COMMERCIAL COAT; HILLESHOG MICROPELLET; METHOCEL A 15LV
methyl isothiocyanate	METHYL ISOTHIOCYANATE
metiram	POLYRAM
metolachlor	DUAL
metribuzin	LEXONE; SENCOR; SENCOR 500; SENCOR 75DF
MICRO-MIST	*Ascophyllum nodosum* extract
MICRO-NIASUL	sulphur
MICROSCOPIC SULPHUR	sulphur
MICROTHIOL SPECIAL	sulphur
mineral oil	FRIGATE; KORNTROL OIL; MINERAL SEAL OIL
MINERAL SEAL OIL	mineral oil
MINTECH	flutriafol
MISTRAL	fenpropimorph
MITAC	amitraz
MO-BAIT	molasses
MON-24004	unknown fungicide
MON-24015	unknown fungicide
MON-24039	unknown fungicide
MONCEREN	BAY-NTN-19701; pencycuron
MONCUT	flutolanil; NNF-136
MONITOR	methamidophos
monolinuron	AFESIN; ARESIN
MORESTAN	chinomethionat
MVP BIOINSECTICIDE	delta-endotoxin of *B.t. kurstaki*
myclobutanil	NOVA; RALLY; RH-3866; UBI-2454; UBI-2454-1; UBI-2454-2; UBI-2561
MYX-1806	delta-endotoxin of *B.t. san diego*
MYX-2284	*B. thuringiensis kurstaki*
MYX-9858	*B. thuringiensis san diego*
N-PROPYL DISULPHIDE	DPDS
nabam	DITHANE D-14; PARZATE LIQUID
naled	DIBROM
napropamide	DEVRINOL
NEEM	azadirachtin
NEEM FORMULATED	azadirachtin + pyrethrum
NEEM SOLUTION 1	azadirachtin
NEEM SOLUTION 2	azadirachtin
NEEMIX	azadirachtin
NEMACUR	fenamiphos
NERO INSECT REPELLENT SOLUTION	deet
NIAGARA FIXED COPPER	copper oxychloride
NITROFEN	herbicide
nitrapyrin	DOWCO-163; N-SERVE
NNF-136	CGF-4280; flutolanil; MONCUT
nonylphenolethylene oxide	AGRAL 90
NOVA	myclobutanil
NOVODOR	*B. thuringiensis tenebrionis*
NTN-33893	imidacloprid
NU-FILM	surfactant
NU-ZONE	imazalil
nuarimol	EL-228
NUSTAR	flusilazole
octylphenoxypolyethoxyethanol n-butanol	COMPANION

ofurace	RE-20615; VAMIN
OKANAGAN DORMANT OIL	okanagan oil
okanagan oil	OKANAGAN DORMANT OIL
OMITE	propargite
ONCOL	benfuracarb
ORBIT	propiconazole
ORGANIC INSECT KILLER LIQUID	*B. thuringiensis kurstaki*
ORTHENE	acephate
ORTHO-12-420	acephate
oxadixyl	GUS-371; GUS-4551; OXYDICIL; SAN-371; SANOFAN
oxamyl	VYDATE
oxycarboxin	HRC; PLANTVAX; UB-I2125; UB-I2216
oxydemeton-methyl	METASYSTOX-R
paclobutrazole	CULTAR; PP-333
paraformaldehyde	PARAFORM F POWDERED FUMIGANT
paraquat	GRAMOXONE; WEEDOL
parathion	AQUA; FOLIDOL; NIRAN; PENCAP E
PARDNER	bromoxynil
Paw Paw bark extract	ASIMICIN; *Asimina triloba* BARK
EXTRACT; F020	
PBO	piperonyl butoxide
PCNB	quintozene
penconazole	TOPAS
pencycuron	BAY-NTN-19701; MONCEREN
PENNCOZEB	mancozeb
PENTAC AQUAFLOW	dienochlor
PENTACHLORONITROBENZENE	quintozene
PERECOT	copper oxides
permethrin	AMBUSH; ATROBAN; ATROBAN DELICE POUR-ON; BOVITECT; ECTIBAN; LIQUIDUSTER; POUNCE; SANBAR; PETRO-CANADA SUPERIOR 70 SPRAY OIL; petroleum oil
petroleum oil	PETRO-CANADA SUPERIOR 70 SPRAY OIL; SAF-T-SIDE; SAFERS ULTRAFINE SPRAY OIL; SMOTHER-OIL; SUNSPRAY OIL; SUPERIOR OIL; SUPERIOR OIL 70; SUPERIOR OIL CONCENTRATE; VOLCK DORMANT OIL; VOLCK OIL; VOLCK SUPREME OIL
phagostimulant	PHEAST
PHALTAN	folpet
PHEAST	phagostimulant
PHEROCON 1CP	pheromone
PHEROCON AM	pheromone
phorate	THIMET
phosalone	ZOLONE
phosmet	IMIDAN
phosphoric acid	PHOSPHORIC ACID
phostebupirim	BAY-MAT-7484; MAT-7484
PHYGON	dichlone
PHYTON-27	metallic copper
PHYTOSOL	trichloronat
picloram	ACIDE PICLORAM; AMDON; PICLORAM ACID; TORDON; TORDON 10K
piperonyl butoxide	BUTACIDE; INCITE; PBO
pirimicarb	PIRIMOR
PIRIMOR	pirimicarb
potassium salts of fatty acids	POTASSIUM SALTS OF FATTY ACIDS
potassium silicate	POTASSIUM SILICATE

poly-d-glucosamine	CHITOSAN
POLYON	polymer coated urea
POLYRAM	metiram
POOL NM	maneb
potassium oleate	SAFERS INSECTICIDAL SOAP; SAFERS SOAP
POUNCE	permethrin
PP-321	cyhalothrin-lambda
PP-333	paclobutrazol
PREMIERE	lindane + thiabendazole + thiram
PREMIERE PLUS	lindane + thiabendazole + thiram
PRO GRO	PRO GRO SYSTEMIC SEED PROTECTANT
PRO GRO SYSTEMIC SEED PROTECTANT	carbathiin + thiram; PRO GRO
prochloraz	SPORTAK
PROMET	furathiocarb
PRO-MIX BX	adjuvant
propargite	OMITE
propazine	PROPAZINE
propiconazole	BANNER; ORBIT; TILT
propoxur	BAYGON
PVC EAR TAG	fenthion
pyrazophos	AFUGAN
pyrethrins	PYRETHRINS
pyrethum	PYRETHRUM
pyridaben	BAS-300
pyrifenox	ACR-3675

quintozene	PCNB; PENTACHLORONITROBENZENE; SCOTTS LAWN DISEASE PREVENTER; TERRACHLOR

RALLY	myclobutanil
RAMIK BRUN	diphacinone
RAPCOL TZ	furathiocarb + metalaxyl + thiabendazole
RAXIL	tebuconazole
RE-20615	ofurace
REGLONE	diquat
RENEX	adjuvant; RENEX 36
RH-0611	myclobutanil + mancozeb
RH-3866	myclobutanil
RH-5598	confidential
RH-5849	1,2-DIBENZOYL-1-TERT-BUTYLHYDRAZINE; TERT-BUTYLBENZOHYDRAZIDE
RH-5992	CONFIRM; tebufenozide
RH-7281	unknown
RH-7592	unknown
RH-7988	unknown
RHC-378	surfactant
RHC-387	unknown
RIDOMIL	metalaxyl
RIDOMIL MZ	mancozeb + metalaxyl
RIPCORD	cypermethrin
RIZOLEX	tolclofos-methyl
RO-13-5223	INSEGAR
RONILAN	vinclozolin
ROTACIDE	rotenone
rotenone	DERITOX; ROTACIDE
ROUNDUP	glyphosate
ROVRAL	iprodione
ROVRAL FLO	iprodione

ROVRAL GREEN	iprodione
ROVRAL ST	iprodione + lindane
ROYAL MH	maleic hydrazide
ROZOL	chlorophacinone
RP EXP-10068	unknown
RU-38702	acrinathrin
S-3206	fenpropathrin
SAF-T-SIDE	petroleum oil
SAFERS INSECTICIDAL SOAP	potassium oleate
SAFERS NEEM INSECTICIDE	azadirachtin
SAFERS SOAP	potassium oleate
SAFERS ULTRAFINE SPRAY OIL	petroleum oil
SAN-371	oxadixyl
SAN-418	*B. thuringiensis tenebrionis*
SAN-619	cyproconazole
SAN-658	captan + cyproconazole
SAN-683	cyproconazole + mancozeb
SANBAR	permethrin
SAVEYh	exythiazox
SCOTTS LAWN DISEASE PREVENTER	quintozene; SCOTTS FFII
SCOTTS PROTURF	chloroneb
SD-208304	DPX-43898
seaweed	seaweed extract
SEVIMOL	carbaryl
SEVIN	carbaryl
SEVIN XLR	carbaryl
SEVIN XLR PLUS	carbaryl
SHELLSHOCK	diatomaceous earth
silicon dioxide	INSECOLO
silicone polyether	SYLGARD; adjuvant
simazine	GESATOP; PRIMATOL S; PRINCEP; PRINCEP NINE-T
SISTHANE	fenapanil
skim milk powder	POWDERED SKIM MILK
SKINTASTIK	deet
SMOTHER-OIL	petroleum oil
SNI OIL	azadirachtin
soap	IVORY LIQUID; SUNLIGHT DISHWASHING LIQUID
sodium aluminum fluoride	KRYOCIDE
sodium bicarbonate	SODIUM BICARBONATE
sodium dioctyl sulfosuccinate	FRANIXQUERRA
sodium fluoaluminate	KRYOCIDE
sodium hypochlorite	JAVEX
sodium selenite	SODIUM SELENITE
SOLACOL	validamycin a
SPORTAK	prochloraz
SPOTLESS	diniconazole
SPUD-CAP	delta-endotoxin of *B.t. san diego*
streptomycin	AGRI-MYCIN; AGRICULTURAL STEPTOMYCIN; AGRISTREP; STREPTOMYCIN SULPHATE
STREPTOMYCIN SULPHATE	streptomycin
SUBDUE	metalaxyl
SULCHEM 92	sulphur
SULFUR	SULCHEM 92; sulphur
SULPHIDE SULPHUR	lime sulphur
sulphur	HOLLYSUL MICRO-SULPHUR; KUMULUS; KUMULUS S; MICRO-NIASUL; MICROTHIOL SPECIAL; SULCHEM 92;

	SULFUR COATED UREA
SUMITHION	fenitrothion
SUNLIGHT DISHWASHING LIQUID	soap
SUNSPRAY	emulsifiable spray oil
SUNSPRAY OIL	petroleum oil
SUPER-CU	tribasic copper sulphate
SUPER TIN	triphenyltin hydroxide
SUPERIOR OIL	petroleum oil
SUPERIOR OIL 70	petroleum oil
SUPERIOR OIL CONCENTRATE	petroleum oil
SUPRACIDE	methidathion
SUSTANE	fertilizers
SYLGARD	adjuvant; silicone polyether
SYSTEM	dimethoate

TACHIGAREN	hymexazol; UBI-2631
TALSTAR	bifenthrin
tebuconazole	BAY-HWG-1608; ELITE; ETHYLTRIANOL; FOLICOTE; FOLICUR; HWG-1608; RAXIL; UBI-2584; UBI-2584-1; UBI-2611
tebufenozide	CONFIRM; RH-5992
tebupirimphos	AZTEC
teflubenzuron	HOE-000522; HOE-00522
tefluthrin	FORCE; ICIA-0993; TF-3754; TF-3755
TELONE	1,3-dichloropropene
TELONE II-B	1,3-dichloropropene
TEMIK	aldicarb
TENN-COP	copper salts of rosin and fatty acids
terbufos	AC-301467; COUNTER
TERRACHLOR	quintozene
TERSAN 1991	benomyl
TD-2343-02	mancozeb
TF-3480	triadimenol
TF-3607	lindane + thiabendazole + thiram
TF-3651	benalaxyl
TF-3656	imazalil + triadimenol
TF-3673	flutriafol
TF-3675	flutriafol
TF-3710	mancozeb
TF-3716	mancozeb
TF-3720	flutriafol + lindane
TF-3753	flutriafol
TF-3754	tefluthrin
TF-3755	tefluthrin
TF-3765	flutriafol
TF-3767	maneb
TF-3767B	maneb
TF-3769	lindane + maneb; MERGAMMA FL
TF-3770	hexaconazole; TF-3770A
TF-3772	benalaxyl
TF-3773	benalaxyl
TF-3775	flutriafol
TF-3785	unknown
TF-3787	unknown
TF-3790	hexaconazole + tefluthrin
TF-3791	tefluthrin + thiabendazole + thiram
TF-3794	paclobutrazol
TF-9480	hexaconazole
thiabendazole	MERTECT; UBI-2395-1; UBI-2531

THIMET	phorate
thiocyclam-hydrogenoxalate	EVISECT
THIODAN	endosulfan
thiodicarb	GUS-80502; LARVIN
thionazin	NEMAFOS; ZINOPHOS
thiophanate-methyl	EASOUT; TOPSIN-M
thiram	UBI-2215; UBI-2233
THURICIDE	*B. thuringiensis kurstaki*
THURICIDE-HPC	*B. thuringiensis kurstaki*
TILT	propiconazole
TILT MZ	mancozeb + propiconazole
tolclofos-methyl	RIZOLEX
TOPSIN-M	thiophanate-methyl
TOPAS MZ	mancozeb + penconazole
TORQUE	fenbutatin oxide
TRI-COP	tribasic copper sulphate
triadimefon	BAYLETON
triadimenol	BAYTAN; TF-3480; UBI-2383; UBI-2383-1; UBI-2541; UBI-2556; UBI-2568
TRIBASIC COPPER	tribasic copper sulphate
tribasic copper sulphate	BASIC COPPER SULPHATE; CLEAN CROP COPPER SPRAY; COPPER SPRAY; CUB; CUPRIC SULPHATE TRIBASIC; SUPER-CU; TRI-COP; TRIBASIC COPPER
trichlorfon	DYLOX
trichloronat	PHYTOSOL
TRIDENT	*B. thuringiensis tenebrionis*; TRIDENT II
triflumizole	UBI-2342
trifluralin	HERITAGE; HOE-FLURAN; JF-8679; RIVAL; TREFLAN; UBI-2309; UBI-2340
triforine	FUNGINEX
TRIGARD	cyromazine
trimethacarb	BROOT; LANDRIN; SD-8530; SD-8736; TF-3627; UC27-BF-32
triphenyltin hydroxide	SUPER TIN
triticonazole	EXP-80318A
TRITON	adjuvant
TRITON B-1956	adjuvant; TRITON B 1956
TRITON XR	adjuvant
TRIUMPH	isazofos
TROUNCE	potassium salts of fatty acids + pyrethrins
TRUBAN	etridiazole
TRUMPET	bendiocarb
TWEEN	adjuvant

UAN	urea ammonium nitrate
UBI-2016-3	carbathiin + lindane + thiram
UBI-2016-4	carbathiin + lindane + thiram
UBI-2051	VITAFLO 280
UBI-2051-1	carbathiin + thiram
UBI-2092	carbathiin
UBI-2092-1	carbathiin
UBI-2100	carbathiin
UBI-2100-2	carbathiin
UBI-2100-4	carbathiin
UBI-2106-1	carbathiin + lindane
UBI-2155	carbathiin + thiram
UBI-2215	thiram
UBI-2233	thiram
UBI-2236	carbathiin + lindane + thiram

UBI-2291	diazinon
UBI-2342	triflumizole
UBI-2359	carbathiin + thiram
UBI-2359-2	ANCHOR; carbathiin + thiram
UBI-2369-1	VITAVAX RS; carbathiin + lindane + thiram
UBI-2379	metalaxyl
UBI-2383	triadimenol
UBI-2383-1	triadimenol
UBI-2389	carbathiin + isofenphos
UBI-2390	carbathiin + thiram; UBI-2390-1
UBI-2390-1	UBI-2390
UBI-2390-3	UBI-2390
UBI-2393	carbathiin + thiabendazole; UBI-2393-2
UBI-2393-2	UBI-2393
UBI-2394	carbathiin + imazalil + thiabendazole;
UBI-2394-2	carbathiin + imazalil + thiabendazole;
UBI-2394-2	UBI-2394
UBI-2395-1	thiabendazole
UBI-2401	carbathiin + imazalil
UBI-2402	carbathiin + lindane + thiabendazole;
UBI-2402-1	UBI-2402
UBI-2413	carbathiin + isofenphos + thiram; UBI-2413-1
UBI-2413-1	UBI-2413
UBI-2417	carbathiin + lindane + metalaxyl; UBI-2417-1
UBI-2417-1	UBI-2417
UBI-2420	imazalil
UBI-2424	carbathiin + imazalil; UBI-2424-1
UBI-2424-1	UBI-2424
UBI-2450	metalaxyl + thiabendazole
UBI-2454	myclobutanil
UBI-2454-1	myclobutanil
UBI-2454-2	myclobutanil
UBI-2457	metalaxyl + thiabendazole
UBI-2484	tebuconazole
UBI-2501	carbofuran
UBI-2509	UBI-2509-1
UBI-2509-1	metalaxyl + thiram; UBI-2509
UBI-2511	carbathiin + cloethocarb + thiram; UBI-2511-1
UBI-2511-1	UBI-2511
UBI-2521	UBI-2521-1
UBI-2521-1	carbathiin + thiabendazole; UBI-2521
UBI-2529	carbathiin + cloethocarb
UBI-2530	carbathiin + isofenphos
UBI-2531	thiabendazole
UBI-2541	triadimenol
UBI-2550	G-696 + lindane + thiram
UBI-2554	carbathiin + cloethocarb + thiram; UBI-2554-1
UBI-2554-1	UBI-2554
UBI-2555	carbathiin + cloethocarb + thiram; UBI-2555-1
UBI-2555-1	UBI-2555
UBI-2556	triadimenol
UBI-2557	carbathiin + cloethocarb + thiram
UBI-2559	cloethocarb
UBI-2561	myclobutanil
UBI-2562	cloethocarb
UBI-2563	G-696
UBI-2564	carbathiin + G-696
UBI-2565	cyproconazole
UBI-2568	triadimenol
UBI-2573	G-696 + thiram

UBI-2575	cyproconazole
UBI-2576	lindane + thiabendazole + thiram
UBI-2584	tebuconazole
UBI-2584-1	tebuconazole
UBI-2584-3	tebuconazole
UBI-2599	lindane
UBI-2599-2	carbathiin + lindane + thiram
UBI-2608-1	carbathiin + imidacloprid + thiram
UBI-2608-3	carbathiin + imidacloprid + thiram
UBI-2611	tebuconazole
UBI-2617	carbathiin + lindane + thiram
UBI-2627	imidacloprid
UBI-2631	hymexazol; TACHIGAREN
UBI-2654	lindane
UBI-2679	chlorpyrifos
UBI-2696	lindane
UBI-2701	bifenthrin
UCB-87	granulosis virus
ULTRA-T	iodine + phosphoric acid
ULTRATHON	deet
UNITRAPS	pheromone
UREA	fertilizer
urea ammonium nitrate	UAN

validamycin a	SOLACOL
VAMIN	ofurace
VAPO	dichlorvos
VECTOBAC	*B. thuringiensis israelensis*
VENDEX	fenbutatin oxide
VIGORO	isobutylidene diurea + quintozene + urea
vinclozolin	RONILAN
VITAFLO 250	carbathiin
VITAFLO 280	carbathiin + thiram; UBI-2051
VITAVAX	carbathiin
VITAVAX 200	carbathiin + thiram
VITAVAX DUAL SOLUTION	carbathiin + lindane
VITAVAX RS	carbathiin + lindane + thiram; UBI-2369-1
VITAVAX SINGLE SOLUTION	carbathiin
VITAVAX SOLUTION	carbathiin
VOLCK DORMANT OIL	petroleum oil
VOLCK OIL	petroleum oil
VOLCK SUPREME OIL	petroleum oil
VOLID	brodifacoum
VORLEX	1,3-dichloropropene + methyl isothio-cyanate
VYDATE	oxamyl

WARRIOR	lambda-cyhalothrin
WL-115110	CASCADE; flufenoxuron
WF-2228	hexaconazole

XE-779	diniconazole
XRD-473	DOWCO-473

ZENECA1	captan
zinc	ZINC SULPHATE
zineb	DITHANE Z-78; PARZATE; PARZATE C; PARZATE-C
ziram	ZERLATE

ZN-0001	experimental
ZN-0002	experimental
ZOLONE	phosalone

PRODUCT LIST / LISTE DES PRODUITS	REPORT NUMBER / NUMÉRO DE RAPPORT
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AC 303,630 + CYPERMETHRIN	28,29,61
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